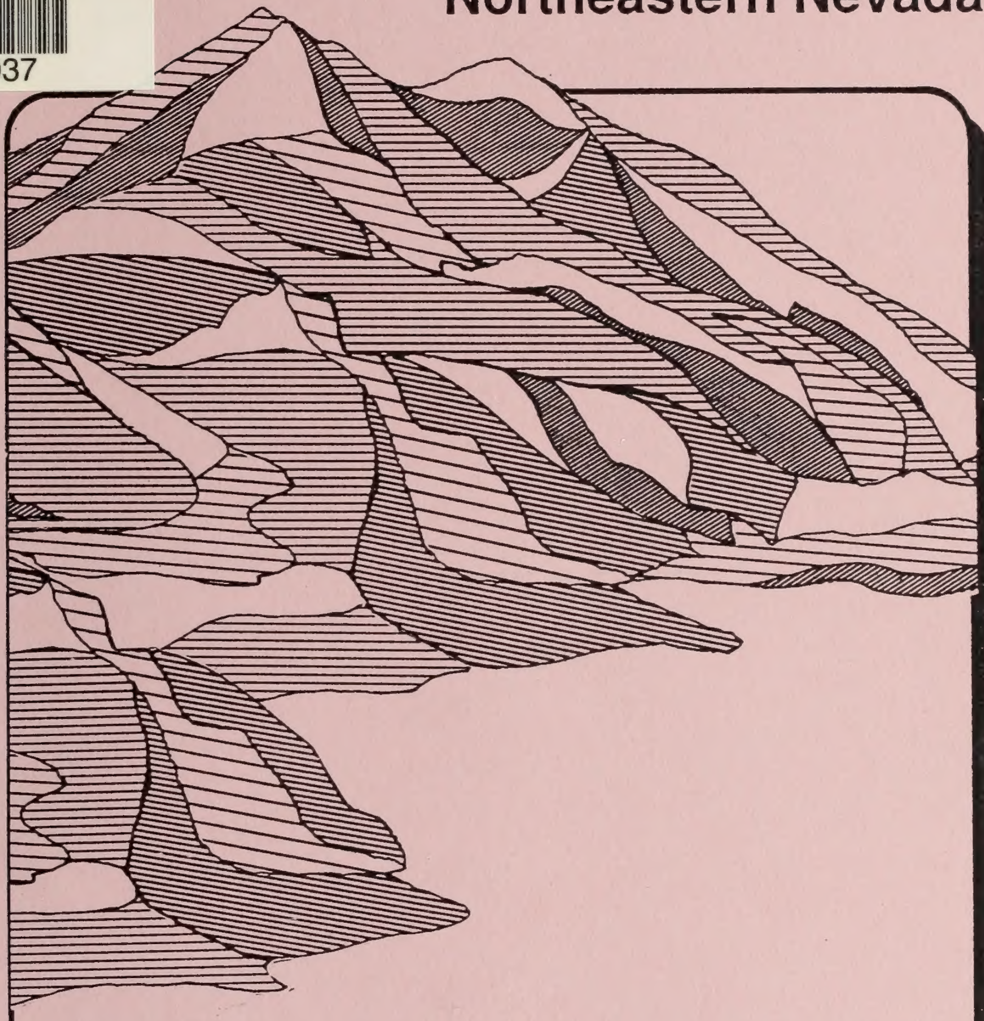
Draft Environmental Impact Statement
Thousand Springs Power Plant
Northeastern Nevada



U.S. Department of the Interior
Bureau of Land Management
Elko District Office
Elko, Nevada

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Acting State Director, Nevada

SUMMARY

[X] DRAFT ENVIRONMENTAL IMPACT STATEMENT　　　[ ] FINAL ENVIRONMENTAL IMPACT STATEMENT

Department of the Interior
Bureau of Land Management
Elko District Office

1. Type of Action: [X] Administrative　　[ ] Legislative

2. Brief Description of Action:

Thousand Springs Generating Company, a consortium of private investors, proposes to enter into a land exchange with the Bureau of Land Management, and subsequently construct and operate an eight-unit, 2000-megawatt, coal-fired, steam-electric power plant in Northeastern Nevada. The land exchange would involve approximately 15,960 acres of public land and 13,410 acres of private land on a surface-estate-only basis. The applicant's intention is to produce competitively-priced electrical energy to be sold to utilities in Nevada, California, Oregon, Washington, and Idaho. Market demand would determine the timing for construction of each unit.

3. Summary of Environmental Impacts:

Environmental impacts would occur on air resources, water resources, ecological resources, cultural and paleontological resources, visual resources, and socioeconomics. Mitigative measures are available to reduce most impacts to insignificant levels. Long-term resource commitments include up to 32,000 acre-feet per year of water. Irreversible commitments include the burning of approximately 224 million tons of coal.

4. Alternatives Considered:

Land tenure adjustments, water supply system locations, access roads locations, and construction worker camp alternatives were considered as means of meeting project objectives.

5. Comments Requested from the Following: See list in Sections 7 and 8.

6 Date of Availability to Environmental Protection Agency and Public:

Draft Environmental Impact Statement: JAN 04 1990

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SUMMARY

INTRODUCTION

This Environmental Impact Statement (EIS) has been prepared for a proposed coal-fired power plant which the Thousand Springs Generating Company (TSGC) plans to construct and operate in Elko County, Nevada (Figure S-1). TSGC is a consortium of investors, with Sierra Pacific Resources acting as project manager for the consortium. The proposed project would require a land exchange with the Bureau of Land Management (BLM) as well as construction and operation of the power plant. This project is named the Thousand Springs Power Plant (TSPP). This EIS has been prepared in compliance with the National Environmental Policy Act.

PURPOSE AND NEED

The stated purpose of the applicant's proposed action is to produce competitively priced electrical energy, using low-sulphur coal from Utah and Wyoming.

Recent utility demand forecasts and surveys of power markets in the western United States indicate that electric consumption in the West will be increasing continuously over at least the next 20 years. These forecasts and surveys indicate that there will be a market for electrical energy by the time the first unit of the proposed project is anticipated to come on line in 1994.

Private land in the Toano Draw area (Figure S-2) was purchased in 1980 in anticipation of constructing and operating a coal-fired power plant. Title to the private lands required for the power plant is held by TSGC. Land status in this part of Nevada, as with much of northern Nevada, follows a checkerboard pattern with ownership alternating between public lands managed by the Federal government and private lands.

The proposed TSPP and ancillary facilities (i.e., access road, wellfields, wastewater evaporation ponds, ash disposal areas, coal storage areas, and railroad corridor) would occupy approximately 1780 acres of land area upon full development. The actual area disturbed during construction would be smaller. Much of the required land area would need to be contiguous to efficiently construct and operate a facility of this size. Therefore, lands in the Toano Draw area presently managed by the BLM would be required to successfully construct and operate a large project. There are three mechanisms by which to acquire legal use of public land: land

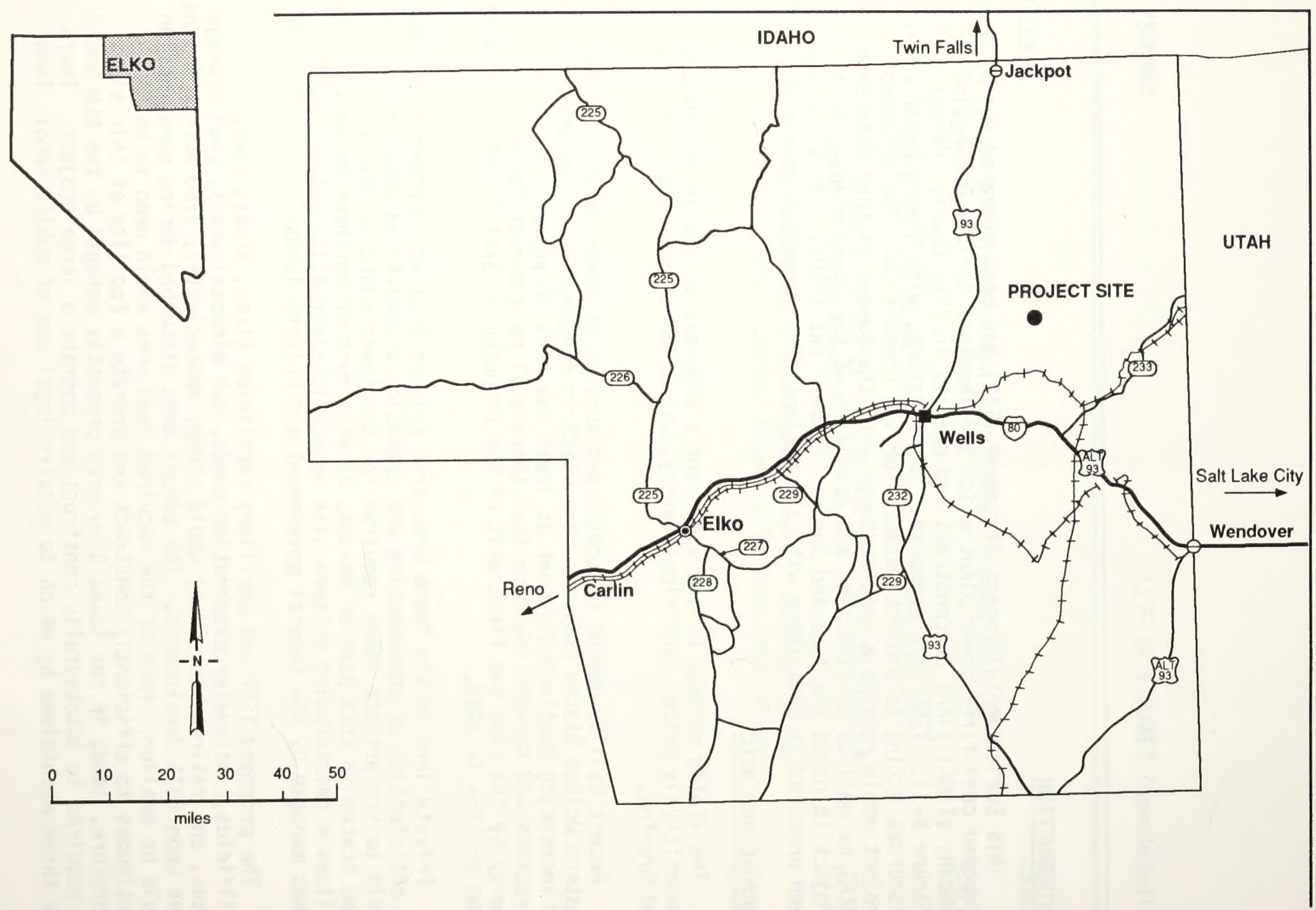

Figure S-1. PROJECT LOCATION MAP

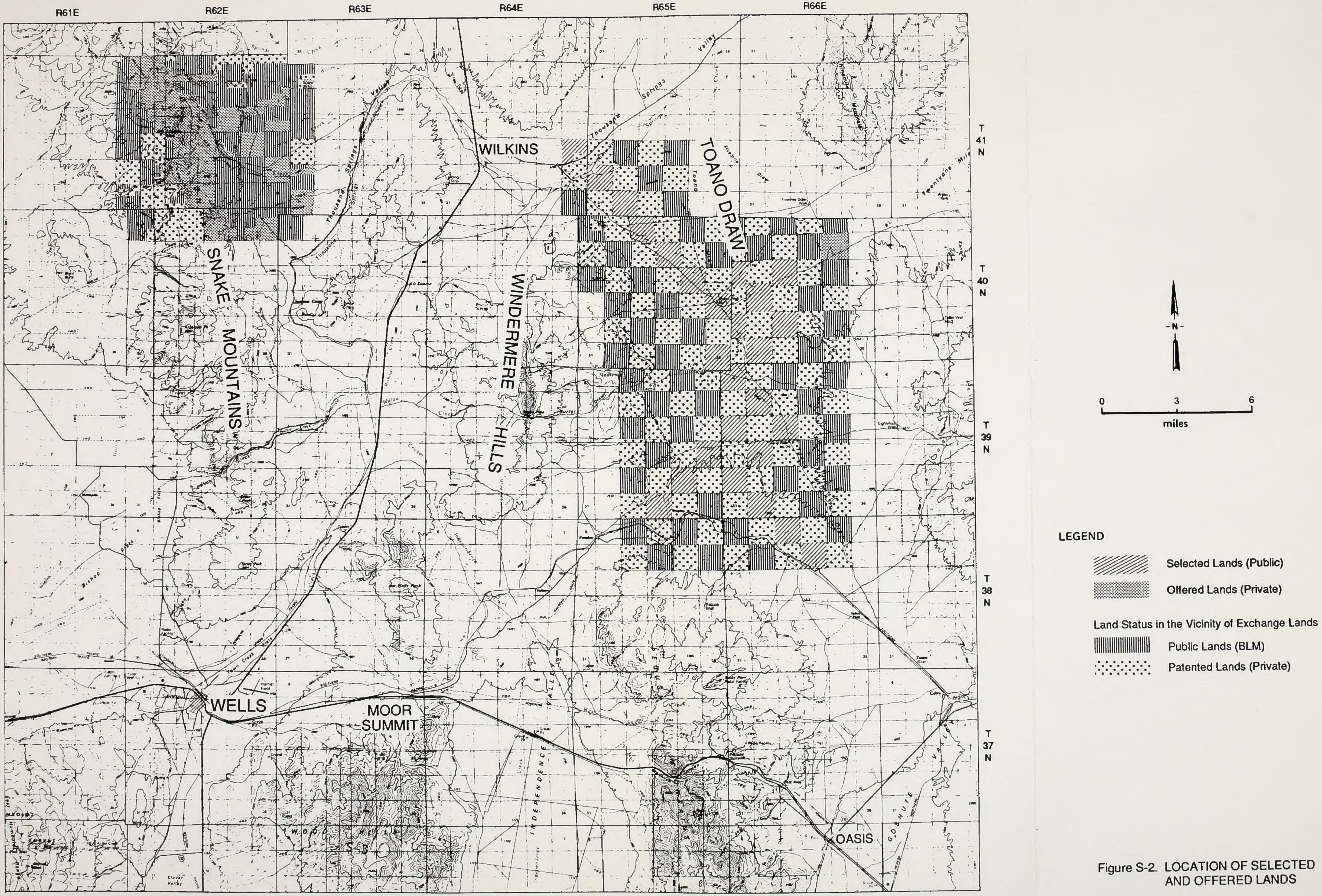

Figure S-2. LOCATION OF SELECTED AND OFFERED LANDS

exchange, land sale, or right-of-way grants. Each of these land acquisition alternatives is analyzed in this EIS.

DESCRIPTION OF PROPOSED PROJECT

LAND ACQUISITION

The first part of the proposed action is to conduct a land exchange between TSGC and the BLM. TSGC has selected approximately 15,960 acres of public lands in Toano Draw and offered, in exchange, approximately 12,770 acres of private land in the Snake Mountains and 640 acres of private land in Toano Draw.

The proposed exchange would proceed on a surface-estate-only basis (i.e., mineral rights to the lands would not be exchanged). Access would be reserved to enable BLM to continue to administer the public lands in the Toano Draw area, and allow public access in all but the immediate project area. TSGC would grant the BLM easements for those previously existing access roads rerouted around the project site. Relocated access would be established by TSGC to the same manner and degree that presently exists.

A summary of resource values associated with the exchange lands is presented in Table S-1.

THE PROPOSED POWER PLANT

The second part of the proposed action is to construct the power plant complex. This would consist of eight coal-fired 250-megawatt (MW) steam-electric generating units and associated ancillary facilities. Each unit is planned to be constructed one unit at a time at approximately 2-year intervals; however, timing for construction would be based on market demand. Construction of the first unit would begin in 1991 and be completed in 1994. Construction of the eighth unit is anticipated to be completed in 2008. Approximately 1780 acres of land would be disturbed at the power plant site, access road, railroad spur, and water pipeline upon completion of development. The construction workforce would first peak at 800 workers in 1993. On-site housing would be provided which could accommodate up to 520 construction workers. Access to the plant site would be off of Highway 93 near Wilkins, 26 miles north of Wells, Nevada.

Coal would be delivered by train from mines at Kemmerer (Wyoming) and Scofield (Utah). Each unit would require one 55-car unit train to be delivered every 5 days from the Scofield mine, and every 4 days from the Kemmerer mine. Four to five 55-car unit trains would deliver coal per day to the plant site with eight units operating. Operation of the power plant would also require approximately 32,000 acre-feet/year (ac-ft/yr) of water at full operation to be used primarily for cooling plant equipment. Waste-water would be disposed of on-site in evaporation ponds. Nonputrescible solid wastes would be disposed of in a landfill located on existing private land within proximity to the plant. Air emissions from the plant would be

Table S-1. SUMMARY OF RESOURCE VALUES ASSOCIATED WITH EXCHANGE LANDS

Value	Selected Lands (Foregone by BLM)	Offered Lands (Acquired by BLM)
1. Forested Land	200 acres	54 acres
2. Wildlife (habitat type)		
Mule Deer Yearlong	4377 acres	0 acres
Mule Deer Winter	459 acres	0 acres
Mule Deer Summer	0 acres	11,241 acres
Antelope Winter	955 acres	0 acres
Antelope Summer	12,536 acres	13,335 acres
Elk Summer	493 acres	0 acres
Elk Winter	986 acres	0 acres
Sage Grouse Lek	3 leks	2 leks
Sage Grouse Brooding Ground	462 acres	630 acres
Sage Grouse Winter	1063 acres	735 acres
Aquatic habitat types	0	31
Streams w/ coldwater fishery	0 miles	6.9 miles
Streams w/ no fishery	0 miles	1.2 miles
3. Rangelands	15,962 acres (1244 AUMs)	13,414 acres (2753 AUMs)
4. Visual[a]	80 acres VRM Class II 1500 acres VRM Class III 14,382 acres VRM Class IV	13,414 acres designated VRM Class IV but including some areas of higher scenic value in Snake Mountains
5. Recreation	Low to moderate Light and dispersed hunting	Moderate to high Hunting, fishing, ORV, hiking
6. Consolidation of public and private land holdings	Yes	Yes

Table S-1. SUMMARY OF RESOURCE VALUES ASSOCIATED WITH EXCHANGE LANDS (concluded)

Value	Selected Lands (Foregone by BLM)	Offered Lands (Acquired by BLM)
7. Access	All access would be retained	All access would be provided in the terms of exchange
8. Threatened or Endangered, or Sensitive Species Potentially Occurring	Federal	Federal
	Bald eagle American Peregrine falcon Ferruginous hawk Swainson's hawk Long-billed curlew White-faced ibis Richard's ground squirrel	Bald eagle American Peregrine falcon Ferruginous hawk Swainson's hawk Long-billed curlew White-faced ibis Richard's ground squirrel
	State	State
	Bald eagle American Peregrine falcon	Bald eagle American Peregrine falcon
9. Minerals	All minerals would be reserved to the U.S.	No BLM authority over development Moderate potential for precious and industrial minerals (gold, silver, and barite) and limited potential for oil and gas resources
10. Water	No water sources owned by Federal Government	BLM would acquire 31 water sources (i.e., springs, seeps) and 8.1 miles of stream BLM would acquire 13.8 ac-ft/yr of water rights

[a] BLM Visual Resource Management Class

controlled by Best Available Control Technology in compliance with state and Federal regulations. Presently proposed is a lime spray dryer scrubber system, a Low-NO_x burner, and a baghouse for the first unit. The definition of the technology would be determined for each steam-electric generating unit as they are proposed, prior to being permitted and developed. Approximately 560 workers would be required to operate the plant upon completion of all eight units. Each unit would be designed to operate for 35 years.

DESCRIPTION OF ALTERNATIVES

In addition to the Proposed Action, several alternatives were identified. Table S-2 summarizes alternatives considered and those selected for analysis.

ENVIRONMENTAL SETTING

Thousand Springs Valley (Figure S-2) is located within the northern Great Basin, the northern portion of the Basin and Range Physiographic Province, a tectonically active region characterized by active uplift and moderate to high levels of seismicity. The region is typified by Basin-Range structure, expressed as north/south-trending isolated mountain ranges bounding internally drained, deeply alluviated valleys. Elevations within the province, on the average, range from 4300 to 5250 feet in the valleys to 6500 to 10,000 feet along the mountain crests.

Locally, the project site is situated within Toano Draw, a slightly elongated, north/northwest-trending basin. This 22-mile-long and up to 15-mile-wide valley has an elevation of about 5700 feet at the proposed TSPP site. The northern end of the valley is crossed by northeast-trending Thousand Springs Creek. Toano Draw is bounded by the Knoll Mountains to the northwest, the Windermere Hills to the west, the Pequop Mountains to the southwest, the Toano Range to the southeast, the Gamble Range to the east, and Ninemile Mountain to the northeast. Valley Pass separates Toano Draw from Goshute Valley to the south.

Thousand Springs Basin is drained by Thousand Springs Creek and its tributaries from west to east to Great Salt Lake Desert. Four north-trending mountain ridges form seven small subareas or subbasins: Herrell Siding Area, Brush Creek Valley, Toano Draw, Rocky Butte Valley (which includes Twentyone Mile Draw), Rock Springs Valley, Crittenden Creek, and Montello Valley (Figure 4.5-2). Three hydrostatigraphic units control groundwater flow in Thousand Springs Basin. Total water resources of the Basin are derived from precipitation falling within the watershed boundary of the Basin.

The annual average temperature measured at the TSPP site over the 1981-1982 time period was 46°F, with a large seasonal temperature variation ranging from a minimum of -13°F to a maximum of 95°F. Annual precipitation totals (average of 9.30 inches) are quite low in the vicinity of the

Table S-2. SUMMARY OF ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Power Generation	Eight 250-MW coal-fired units	Solar Wind Nuclear Fusion Geothermal Hydroelectric Solid Waste Cogeneration Oil or Natural Gas Nuclear Fission No Action	No Action
Site	Toano Draw	Nine Candidate Site Regions Throughout the State	Analyzed in Regional Site Evaluation/ Selection Study (WCC 1980)
Access Road	Off of Highway 93 near Wilkins	Moor Summit Off Interstate 80	Moor Summit
		Brush Creek Off of U.S. Highway 93 3.5 Miles South of Wilkins	Brush Creek
Railroad	Off of Southern Pacific near Cobre	Off of Union Pacific near Wells Paralleling U.S. Highway 93	None due to grade constraints
Construction-Worker Accommodations	On-site Construction-Worker Camp and RV Park	Construction-Worker Camp and RV Park Near Cobre Construction-Worker camp and RV Park Near Wilkins No Construction-worker camp	No Construction-Worker Camp

Table S-2. SUMMARY OF ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (continued)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Cooling System	Mechanical Draft Cooling Towers	Natural Draft Cooling Towers	Not analyzed due to high temperatures and low humidity levels in project area
		Cooling Ponds	Not analyzed due to large land requirements and high water loss
		Dry Mechanical Draft Cooling Towers	Not analyzed due to large land requirements and reduced efficiency
		Wet/Dry Towers	Not analyzed due to large land requirements
Water Supply	Wellfield for 3 Units South of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity	Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 1 Unit North of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity	Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 1 Unit North of Plant Site in Toano Draw; Wellfield for 5 Units in Gamble Ranch Vicinity
		Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 6 Units in Gamble Ranch Vicinity	Wellfield for 2 Units South of Plant Site in Toano Draw; Wellfield for 6 Units in Gamble Ranch Vicinity

Table S-2. SUMMARY OF ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (continued)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
Oxides of Nitrogen Control	Low-NO_x burner with combustion modification	Selective Catalytic Reduction with Ammonia	Not analyzed due to lack of commercial demonstration of adequacy on utility size coal-fired boiler
		Noncatalytic Reduction with Ammonia	Same as above
		Noncatalytic Reduction with Urea	Same as above
		Low-NO_x Burner	Less efficiency than low-NO_x burners with combustion modification
		Flue Gas Recirculation	Same as above
		Fluid Bed Combustion	Not analyzed due to high water consumption
Sulfur Dioxide Control	Lime Spray Dryer	Wet Scrubber	Not analyzed due to high water consumption
		Fluid Bed Combustion	Not analyzed due to lack of commercial demonstration of adequacy
		Limestone Injection into Furnace	Not analyzed due to low control efficiency

Table S-2. SUMMARY OF ALTERNATIVES CONSIDERED AND THOSE SELECTED FOR ANALYSIS (concluded)

Project Component	Proposed Action	Alternatives Considered	Alternatives Selected for Analysis
		Dry Lime Injection into Duct	Not analyzed due to low control efficiency, and lack of commercial demonstration of adequacy
Particulate Matter Control	Baghouse	Electrostatic Precipitator (ESP)	Not analyzed, as a baghouse system is strongly preferred for use with lime spray dryer for SO_2 control
		Carbon Monoxide Catalysts	
Land Acquisition	Land Exchange	Right-of-Way Grants	Right-of-Way Grants
		Selling the Public Lands	Selling the Public Lands
		No Action	No Action

proposed site, due to the presence of the Sierra Nevada Mountains and numerous smaller mountain ranges to the west. Wind speeds are generally low at both Elko and the TSPP site. Relative humidity is generally low, due to the semi-arid conditions in the vicinity of the proposed power plant site. Due to the dry nature and low levels of air pollution in the area, visibility is excellent. The occurrence of severe weather conditions near the site is infrequent and of short duration.

The project is located in an area that has been designated as "attainment" of Federal National Ambient Air Quality Standard for all criteria pollutants (ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead). That is, based on the Federal standards set for the study area, the ambient air has no exceedances of the standards. The area is classified by the Environmental Protection Agency as "Group III" with respect to fine particulates (particulate matter smaller than 10 μm, PM_{10}), which means the area has less than a 20 percent chance of exceeding the Federal PM_{10} standards. In addition, the area is currently in attainment of all applicable Nevada air quality standards. Ambient concentrations monitored in 1981-1982 are well below the National Ambient Air Quality Standards.

Within the plant site area and Toano Draw exchange lands, including Thousand Springs Creek, the following vegetation types were identified: Black Sagebrush, Shadscale, Saltbush, Big Sagebrush, and Riparian. Four major vegetation types were identified as occurring on the Snake Mountain offered lands area, including Mountain Brush, Low Sagebrush, Big Sagebrush/Bluebunch Wheatgrass, and Riparian types. Wildlife species include antelope, elk, and mule deer. Beaver, mink, skunk, and badger may also occur in the study area. Thirteen raptorial species were observed using the various vegetation associations within the study area of influence. Sagegrouse are an important upland species in the area. Fish populations include a self-sustaining population in Thousand Springs Creek and its tributaries and reservoirs, while populations in Crittenden Reservoir are maintained by stocking.

The project area lies within the territory of the Western Shoshone. Five themes are identified that structured historic period events in northeast Nevada. Of these, fur trapping, mining, and major settlements occurred in the region but had limited impact on the study area. Remaining themes are transportation and ranching. A total of 457 cultural resource sites have been identified in the study area to date. Chronological indicators allowed assignment of 51 sites to periods that indicate that Toano Draw has been occupied by a variety of indigenous groups from Paleo-Indian to Post-Formative times (12,000 to 100 years ago).

The project site is located approximately 40 miles from the City of Wells (population of 1400), 90 miles from the City of Elko (population 16,000), 55 miles from Jackpot (population 1500), and 98 miles from Twin Falls, Idaho (population 27,750). One interstate highway (I-80) and one U.S. Highway (93) serve the project area.

Recent population growth in Elko County is associated with gold mining. Population of the City of Elko has increased approximately 20 percent from 1987 to 1988, which has placed stress on the community services, including schools, medical care, and water and sewer supply. The tax revenue cap imposed by the State of Nevada has created difficulties in hiring additional service providers. Population of the City of Wells has increased by approximately 15 percent since 1980. Vacant housing in Wells and Elko is virtually nonexistent but Elko has responded with a recent increase in new construction.

ENVIRONMENTAL CONSEQUENCES AND RECOMMENDED MITIGATION

Potential environmental impacts and suggested mitigation measures to reduce the impacts from the proposed action and alternatives are summarized in Tables 3.3-1 and 3.3-2 (Section 3.3). Residual environmental impacts, those impacts that would remain after implementation of the suggested mitigation, are discussed in Section 5.18.

1.0 INTRODUCTION

1.1 PROJECT OWNERSHIP AND HISTORY

This Environmental Impact Statement (EIS) has been prepared because the proposed action, land exchange, construction, and operation of the Thousand Springs Power Plant (TSPP) is considered a "major Federal action significantly affecting the quality of the human environment" (NEPA, P.L. 91-190, as amended, Sec. 102(c)). The TSPP is proposed by the Thousand Springs Generating Company (TSGC) in Elko County, Nevada (Figure 1.1-1). TSGC is a consortium of investors whose membership is as follows: Sierra Pacific Resources (SPR); Bonneville Pacific Corporation; Coastal States Energy Company; Foster Wheeler Corporation; Kidder Peabody and Company; Pittsburg and Midway Coal; Robert L. Helms Construction and Development; and Westinghouse Electric Corporation.

Sierra Pacific Resources is acting as project manager for the consortium. The proposed project involves a land exchange with the Bureau of Land Management (BLM) and construction and operation of the power plant. The project is called the Thousand Springs Power Plant (TSPP) project. This EIS has been prepared in compliance with Federal, state, and local regulations. This introductory section presents a brief summary of the project history and describes the NEPA process for the project.

In 1985, the Nevada State Legislature amended Chapter 704 of Nevada Revised Statutes with Senate Bill No. 490. This bill exempts "private construction of utility facilities from certain requirements which are not directly related to environmental considerations" (S. 490 1985). This legislation is unique in the United States by allowing an independent power producer in Nevada (i.e., TSGC) to propose this action. Senate Bill No. 490 allows for the export of electrical energy provided that public utilities within the state are offered the opportunity to purchase the energy before it is offered to out-of-state utilities.

The project discussed herein is the second proposal for a coal-fired power plant on this site. The first proposal was made by Sierra Pacific Power Company (SPPC) in 1981, but was later withdrawn. In 1985, another project proposal was made by SPR, in conjunction with several corporate investors. It differed from the earlier proposal in plant size and in several technical respects. At that time, Lands of Sierra, Inc. (LOS) (a subsidiary of SPR) filed an application with the BLM (Elko District Office)

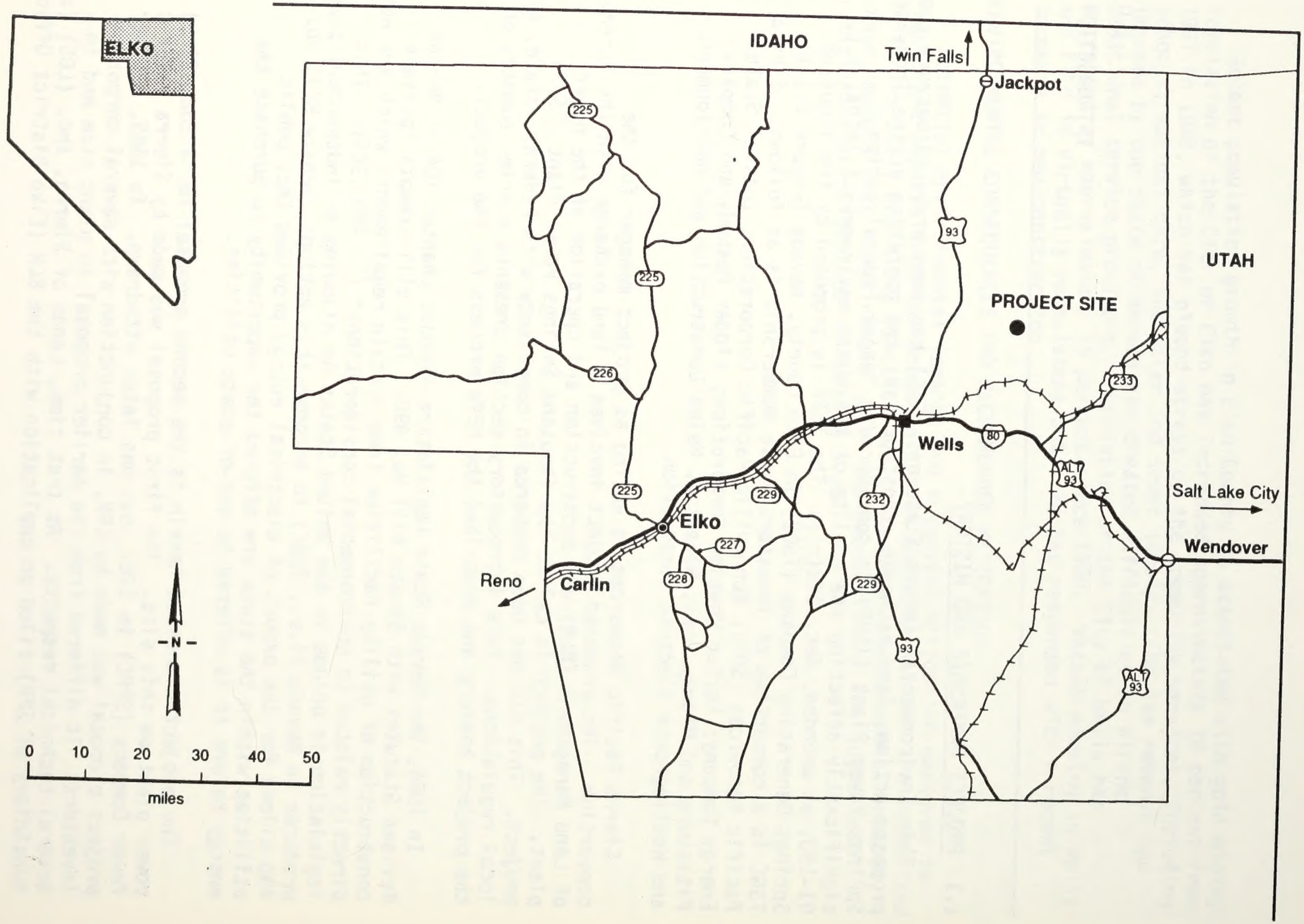

Figure 1.1-1. PROJECT LOCATION MAP

for a land exchange between LOS and the BLM. In 1986, LOS filed an amendment to the application to modify the exchange proposal to include lands suitable for construction and operation of the proposed power plant. In 1988, the TSGC was formed, incorporating the eight companies named above and designating SPR as its manager. Lands of Sierra transferred title of their lands in Toano Draw to TSGC in 1989. It was determined that compliance with NEPA would require the development of an EIS to properly assess the modified proposal. Based on the amended application, the "proposed action" that is the subject of this EIS consists of three components:

- An exchange of land between TSGC and the BLM

- Construction of a power plant complex, consisting of eight 250-MW coal-fired electric power generating units with ancillary facilities

- Operation of each unit for a period of up to 35 years

1.2 <u>OVERVIEW OF ENVIRONMENTAL REVIEW AND LICENSING PROCESS</u>

1.2.1 NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) REQUIREMENTS

NEPA (P.L. 91-190, as amended), as described in the Council on Environmental Quality regulations (40 CFR 1500), is the basic national charter for protection of the environment. This Act establishes policy, sets goals, and directs the carrying out of the policy. NEPA procedures also ensure that environmental information is available to public officials and citizens before actions which could impact the environment are taken. The NEPA process is intended to help public officials make decisions that are based on an understanding of environmental consequences, and to take actions that protect, restore, and enhance the environment (40 CFR 1500.1).

All proposed actions affecting public lands or resources under Federal jurisdiction must be reviewed for NEPA compliance. Proposed actions fall into one of five categories, as follows:

- Actions which are exempt

- Actions which are categorically excluded

- Actions which are covered by an approved environmental document

- Actions which require preparation of an Environmental Assessment

- Actions which require preparation of an EIS (BLM 1988a)

The proposal by the applicant to conduct a land exchange and construct and operate a power plant was reviewed by the BLM, the lead agency, which determined that preparation of an EIS was required.

The NEPA process includes an early and open process (known as "scoping") for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. The lead agency issues a notice of intent in the Federal Register to initiate the scoping process. The intent of the scoping process is to focus on environmental issues of concern.

The first Notice of Intent to prepare an EIS and to conduct scoping for the proposed project was published in the Federal Register on May 21, 1986. Comments were accepted until July 11, 1986 with public scoping meetings held in Reno, Wells and Elko, Nevada, on June 23, 24, and 25, 1986, respectively.

In October 1987, the proposed project was delayed pending a decision by the Securities Exchange Commission as to whether the project's ownership was subject to the conditions of the Utilities Company Holding Act of 1937. In January 28, 1988, the Commission ruled that the project's ownership was not subject to this Act. The TSPP consortium decided to resume permitting activities in March 1988. On June 16, 1988, a second Notice of Intent to prepare an EIS and conduct a scoping meeting was published in the Federal Register to initiate a 30-day comment period. This was necessary due to the amount of time that had elapsed since the last public scoping period in 1986. A public scoping meeting was held in Wells, Nevada, on July 6, 1988.

Input from scoping activities has been incorporated into the scope of the EIS. Significant issues and alternatives were defined on the basis of this input, and information from the applicant. Public agencies and other parties interested in participating during the preparation of the EIS were identified during the scoping process.

After the draft EIS has been prepared, comments will be obtained from any Federal agency which has jurisdiction by law or special expertise. The lead agency also requests the comments of appropriate state and local agencies, Indian tribes, the applicant, and the public. The final EIS will contain responses to the comments.

1.2.2 ROLES AND RESPONSIBILITIES

The following is a summary of the roles and responsibilities of the agencies that have jurisdiction by law or special expertise and are involved in the EIS preparation and review process.

1.2.2.1 Bureau of Land Management

Seventy-four percent of Elko County in which the proposed project and alternatives would be located is public lands managed by BLM. The BLM manages approximately half of the land affected by the proposed action. The BLM also has responsibility for administering and permitting rights-of-way from the applicant for alternatives to this proposed exchange and for

subsequent transmission facilities. The BLM is the lead agency for this EIS and is responsible for ensuring that this proposed project is in compliance with Federal regulations.

1.2.2.2 National Park Service

The National Park Service is the Federal agency charged with the administration and protection of national parks and national monuments. Under Prevention of Significant Deterioration air quality regulations, the National Park Service is the "Federal Land Manager" for their Class I areas. Craters of the Moon National Monument is the nearest National Park Service Class I area that could be affected by emissions from the proposed TSPP. The National Park Service is a Cooperating Agency for this EIS.

1.2.2.3 Fish and Wildlife Service

This agency must be consulted about possible impacts to plants and animals identified and listed in the Federal Register as threatened or endangered. Also, pursuant to Section 7 of the Endangered Species Act (P.L. 95-632), the BLM is required to ensure that its programs do not jeopardize the existence of threatened or endangered species, and do not destroy or modify sensitive habitats. USFWS will provide the Department of the Interior's official comments on the Corps of Engineers permit, under the Fish and Wildlife Coordination Act.

1.2.2.4 U.S. Geological Survey

The primary responsibilities of the U.S. Geological Survey are the identification of the Nation's land, water, energy and mineral resources, and the classification of Federally-owned lands for mineral and energy resources and water power potential. To these ends, the U.S. Geological Survey prepares maps and digital and cartographic data, collects and interprets data on energy, mineral, and water resources, performs fundamental and applied research in the sciences and techniques involved, and publishes and disseminates the results of its investigations in maps and reports. As a cooperating agency for this EIS, the U.S. Geological Survey provided data and reviewed water resources analyses, as requested by the Nevada State Engineer.

1.2.2.5 Environmental Protection Agency (EPA)

The EPA is responsible for administering Federal air quality and emissions standards. The EPA has oversight jurisdiction over Prevention of Significant Deterioration and national ambient air quality standards administered at the state level by the Nevada Department of Conservation and Natural Resources, Division of Environmental Protection. The EPA also has oversight authority for ensuring that Best Available Control Technology is utilized, and that emissions limits and monitoring requirements are followed. EPA is a Cooperating Agency for this EIS.

The EPA has authority over hazardous waste management and disposal pursuant to 40 CFR 122, 124 (Notification of Hazardous Waste Activities, Hazardous Waste Permit Application), which would apply to any hazardous waste generated at the proposed facility. Procedures for compliance with

EPA standards are administered by the Nevada Division of Environmental Protection.

1.2.2.6 Forest Service

Under the Prevention of Significant Deterioration air quality regulations, the Forest Service is the "Federal Land Manager" for their Class I areas. The Federal Land Manager has an affirmative responsibility to protect "air quality related values" in their Class I areas and has the authority to demonstrate whether a proposed project would have an adverse impact on such values. The Jarbidge Wilderness Area is the closest Forest Service Class I area that could be affected by emissions from the proposed TSPP. The Forest Service is a Cooperating Agency for this EIS.

1.2.2.7 Army Corps of Engineers

The Army Corps of Engineers has jurisdiction over the waters of the United States, including regulation of activities such as dredging, filling, and discharging of pollutants to surface waters such as navigable waters and their tributaries, interstate waters and their tributaries, all wetlands adjacent to those waters, and all impoundments of those waters.

Under Section 404 of the Clean Water Act, the Corps has jurisdiction to authorize a permit for the discharge of dredged or fill material into the waters of the U.S. Permits are evaluated according to EPA guidelines (40 CFR 230) and are subject to terms and conditions established by the Corps. The Army Corps of Engineers is a Cooperating Agency for this EIS.

1.2.2.8 The State Historic Preservation Office (SHPO) and Advisory Council on Historic Preservation (ACHP)

As required by the National Historic Preservation Act of 1966, as amended, the State Historic Preservation Office and the Advisory Council on Historic Preservation will consult with the BLM to determine whether cultural resources eligible for or listed in the National Register of Historic Places are located in the project area. If eligible or listed properties are identified in the project area, the SHPO and the ACHP will consult with the BLM as to the project's affect on the resources. As mandated by Section 106 of the National Historic Preservation Act, the BLM will devise a plan to minimize effects to cultural resources. This plan will be reviewed for adequacy by the State Historic Preservation Office and the Advisory Council.

1.2.2.9 State of Nevada Department of Wildlife (NDOW)

NDOW is responsible for wildlife management within the state and maintains a listing of wildlife species managed under state law. The BLM is responsible for habitat management on BLM-administered public lands. Close coordination will be required with NDOW in order to evaluate impacts of the proposed action and alternatives on wildlife. Ongoing studies of baseline biological conditions have been conducted in cooperation with NDOW. Protocols for baseline and impact studies also have been developed with NDOW.

1.2.2.10 State of Nevada Department of Conservation and Natural Resources

The Nevada Division of Environmental Protection (NDEP), within this department, is responsible for administering and enforcing environmental regulations in many areas, including air quality, water quality, hazardous and solid waste handling and disposal, and wastewater disposal. The NDEP has responsibility for issuance of air quality permits to operate under the authority of Nevada Revised Statutes (NRS) 445 and PSD permits under the authority of the EPA. The waste management section of the NDEP administers EPA regulations for hazardous waste disposal (40 CFR 122,124), and is the permitting agency for approval to operate solid waste treatment and disposal systems (NRS 444). The NDEP also regulates surface discharge of wastewater, through the issuance of National Pollutant Discharge Elimination System permits. The NDEP has authority over water pollution control under the Nevada Water Pollution Control Act (NRS 445) and regulates the quality of groundwater resources in the state.

The Office of the State Engineer, Division of Water Resources, also within this department, is responsible for administering Nevada water laws. The State Engineer has authority over the adjudication of water rights and the appropriation of public surface waters and groundwaters. The office also regulates and inspects dams, reservoirs, and wells. Permits issued by the State Engineer for appropriation of public waters limit the place of use, point of diversion, quantity, and manner of use, and prevent possible interference with prior water rights (NRS 533,534).

1.2.3 AUTHORIZING ACTIONS

Implementation of the applicant's proposed action or any alternatives would require several authorizing actions from the BLM and other cooperating agencies. Authorizing actions are direct approvals, permits, and licenses required, such as right-of-way grants, stream crossing permits, and others. Table 1.2-1 summarizes the potentially applicable major environmental laws, ordinances, regulations, and standards of cooperating Federal and state agencies.

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION

Agency	Type of Permit or Approval	Applicability	Authority
FEDERAL			
Federal Aviation Administration (FAA)	FAA Form 7460-1	No-hazard Declaration is required if construction or alteration is more than 200 feet in height.	49 USCA 1501 14 CFR 77
		Transmission line construction.	49 USCA 1348 14 CFR 77
Army Corps of Engineers	404 Permit	Required of any activities affecting isolated wetlands and streams which are tributaries to interstate waters or adjacent to navigable waters.	Clean Water Act 33 USCA 401 et seq. 33 USCA 1344 33 USCA 1413-1414 33 CFR 320,323
	Section 10 Permit	Placement of structures and work in in navigable waters.	River and Harbors Act
	Executive Order 11990 Protection of Wetlands	Considerations to be taken in the protection of wetlands.	EO 11990
Environmental Protection Agency (EPA)	Prevention of Significant Deterioration (PSD)/ Determination of Compliance (DOC)	Federal air quality and emission standards, PSD increment and national ambient air quality standards must be met, and Best Available Control Technology (BACT) utilized. Emission limitations and monitoring requirements apply to all sources.	Clean Air Act 40 CFR 50 to 87 40 CFR 52.21
	New Source Performance Standards (NSPS)	Review of all new electric utilities employing boilers.	40 CFR 60

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION (continued)

Agency	Type of Permit or Approval	Applicability	Authority
FEDERAL (cont.)	Notification of Hazardous Waste Activities, Hazardous Waste Permit Application	Would apply to any hazardous waste generated at the proposed facility.	40 CFR 122, 40 CFR 124
	National Pollutant Discharge Elimination System (NPDES)	Could be required if hydrostatic pipeline test water is discharged to Thousand Springs Creek or any other streams.	40 CFR 230
	Superfund Amendments and Reauthorization Act, Title III (SARA)	Requires reporting of listed chemicals and any emergency releases. Certain facilities must also report estimates of listed chemical emissions to the land, water, and air.	40 CFR 372
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 Consultation regarding the Endangered Species Act, Fish and Wildlife Coordination Act, and the Migratory Bird Act	Informal consultation required to determine if any project facilities could jeopardize the continued existence of any endangered species.	16 USCA 742 *et seq.* 1531 *et seq.* 50 CFR 17
	Migratory Bird Treaty Act	Protection of Migratory Birds.	16 USC 703-711 50 CFR Ch 1
	Guidelines for Review of Fish and Wildlife Aspects of Proposals in or Affecting Navigable Waters	Protection of vegetated and other productive shallow waters.	FR Vol. 40, No. 231
U.S. Forest Service	Wilderness Act	Preservation of air quality in adjacent designated wilderness areas.	16 USC 1131-1136

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION (continued)

Agency	Type of Permit or Approval	Applicability	Authority
FEDERAL (cont.)			
Advisory Council on Historic Preservation	Section 106 Compliance	The National Historic Preservation Act requires any federal agency issuing permits to take into account actions affecting significant cultural resources, and allow the Advisory Council on Historic Preservation to comment.	36 CFR 800
	Antiquities Act	Protection of historic, prehistoric monuments, or objects of antiquity on federal lands.	P.L. 59-209 16 USC 431-433
	Executive Order 11593	Protection and enhancement of the cultural environment. An expansion on federal agency responsibilities with respect to the NHPA, and specifies a relationship between NHPA and NEPA.	EO 11593
	Archaeological Resource Protection Act	ARPA permit is required for collection from and excavation of archaeological sites on lands managed by a federal agency.	P.L. 96-95 16 USC 470a
	American Indian Religious Freedom Act (AIRFA)	Federal agency's permitted projects must not, insofar as possible, adversely affect sites of Native American religious and cultural values.	American Indian Religious Freedom Act (1978)

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION (continued)

Agency	Type of Permit or Approval	Applicability	Authority
FEDERAL (cont.)			
Advisory Council on Historic Preservation (cont.)	National Trails System Act	Protection to segments, sites, and features related to the California Emigrant Trail in Thousand Springs Valley.	P.L. 90-543 16 USC 1241-1249
Bureau of Land Management	Right-of-Way (ROW) grant	Construction and operation of water pipelines and transmission lines, roads, railroad, communication facilities, and other ancillary facilities.	P.L. 94-579
	Land Exchange	Provides for exchange of land between public and private parties.	P.L. 94-579 43 USC 1701
	Sale	Provides for sale of public land.	
Federal Highway Administration, Dept. of Transportation	Review of undertakings involving interstate highways	Encroachment into interstate right-of-ways.	49 CFR 300
Federal Railroad Administration, Dept. of Transportation	Review and authorization of undertakings involving the construction and operation of railways	Construction and operation of railroad spur line.	49 CFR 200

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION (continued)

Agency	Type of Permit or Approval	Applicability	Authority
NEVADA			
Nevada Department of Transportation	Encroachment Permit	Encroachment into State Roadway ROW.	Nevada Revised Statutes (NRS) 408.423
Nevada Division of Environmental Protection	Letter of Authorization	Establishment of private Class III solid waste disposal site.	Nevada Administrative Code (NAC) 444.570 to 444.748 NRS 444
	Prevention of Significant Deterioration (PSD)/ Permit to Construct and Operating Permits	The EPA has granted Nevada authority to implement PSD, state and national ambient air standards, and BACT; see EPA above. Requires analysis of toxic or hazardous air contaminants and development of BACT for toxics.	NAC 444.430 to 445.846
	Nevada Water Pollution	Quality of Groundwater	NRS 445
Nevada Division of Health	Approval for potable water supply system	Water supply system for construction work camp and operation facilities.	
Division of Water Resources	Permits for Appropriation of Public Waters	To identify and limit the place of use point of diversion, quantity and manner of use, and prevent possible interference with prior water rights.	NRS 533,534

Table 1.2-1. ENVIRONMENTAL LAWS, ORDINANCES, REGULATIONS, AND STANDARDS POTENTIALLY REQUIRED FOR AUTHORIZATION OF THE PROPOSED ACTION (concluded)

Agency	Type of Permit or Approval	Applicability	Authority
NEVADA (cont.)			
Nevada Dept. of Wildlife	Authority to protect and manage all wildlife species	Authorizes the existence and operation of NDOW to protect all wildlife species	NRS 501-505
	Identifies all wildlife species under jurisdiction of NDOW		NAC 503

2.0

PURPOSE AND NEED

2.1 PURPOSE AND NEED FOR POWER

The applicant has stated that the proposed power plant would produce competitively priced electrical energy using low-sulfur coal from Utah and Wyoming. The electricity would be sold to utilities in the Western region of the U.S., including the states of Nevada, California, Oregon, Washington, and Idaho. At present, the applicant has identified these states as their marketing region, but this may be subject to change in the future as market demands change.

The applicant has stated that the decision to pursue development of the proposed Thousand Springs Power Plant (TSPP) project was based on the preference of utilities over the past decade to purchase electricity, rather than build new facilities to meet their incremental power needs. The applicant determined that this trend is expected to result in a growing market for wholesale electric power generated by producers that can supply large amounts of reliable "baseload" power when and where needed, as well as help meet the growing peak demands in the Western region of the nation.

The applicant has indicated that the proposed TSPP project would be constructed in eight phases by unit. It is the stated intent of the applicant not to begin construction on any of the planned eight units until power purchase agreements have been signed committing the energy to be produced by each unit. The power produced by the proposed project would be sold to regulated utilities. Those utilities would be required to demonstrate their need for power in their respective states before they can obtain regulatory approval of the power purchase agreements.

State-level Public Utility Commissions in the TSPP marketing region (Nevada, California, Idaho, Washington, and Oregon) require that public utilities satisfy their Least Cost Planning Criteria for purchasing electricity. These criteria require that electric power be obtained at the least cost available on the open market. Such policies often lead public utilities to purchase power rather than generate additional power. To satisfy the Least Cost Planning Criteria, public utilities in western states have been sending out Requests for Proposals to electrical generators, including independent power producers such as TSGC, to solicit offers from suppliers. TSGC has received four Requests for Proposals from utilities and is presently negotiating with two of them for power purchase

agreements as of December 1989. The applicant hopes to confirm contracts for power by 1991.

The following section (2.1.1) describes the forecast demand for electricity in the West and how utilities, power generators, and regulatory agencies forecast power requirements for the future. Section 2.1.2 discusses the interrelationship of the proposed TSPP project with existing and future transmission facilities, and the regulatory framework required to sell power generated by the proposed project and transmit it to consumers.

2.1.1 DEMAND FORECAST FOR POWER IN THE WESTERN U.S.

2.1.1.1 Characteristics of the Regional Power Supply System and Needs

Electricity is supplied to the Western U.S. through a diverse system of power generators and transmission networks. This system consists of a variety of utilities, including rural, municipal, and investor-owned utilities. These utilities supply and exchange electrical power over both long- and short-term contractual periods depending on the requirements of the utility system distributing the power and the availability and reliability of the electricity.

Over a decade ago, the majority of electrical power was produced from oil- and natural gas-fired power plants, generally owned and operated by the same utilities that distributed and sold the electricity. Currently, the sources of electrical energy are more diverse, consisting of nuclear, coal, geothermal, cogeneration, and renewable resource generation (e.g., hydroelectric, biomass, and wind). There is now an emerging trend for electrical generating facilities to be owned and operated by independent entities that sell the power to the utilities. The result is that electrical energy is available from an open market. In-state, local utilities generate a large quantity of the electrical power in many areas. However, the construction and operation of large-capacity utility transmission lines have interconnected most states and regions in the West, enabling bulk power to be imported and exported as regional demand increases, or as seasonal variations in electrical demand and supply occur. The transactions in power occur between utilities that may have partial ownership in out-of-state generation sources, or that have entered into contractual arrangements for the purchase of electric power. These arrangements can be long-term, where a utility seeks power from an economical and dependable source, thereby meeting future demand while avoiding the costs, risks, and required planning and lead-time necessary to permit, construct, and operate a new power plant of its own. Power purchase arrangements can also be short-term, where a utility may seek additional power capacity during a peak seasonal period, or during a very short "spot" period when unexpected demand shifts occur, when replacement is necessary for generators that unexpectedly shut down, or when surplus power is available at low rates (thus enabling a utility to purchase less expensive electricity and temporarily shut down other less efficient generating sources).

The need for power also varies by "load" characteristic. Within a given area, a predictable, relatively constant quantity of electrical energy is needed to supply consumers on a daily basis. This is often referred to as the baseload, and utilities may supply this from generation sources which can deliver constant, dependable electricity. However, daily fluctuations occur in electrical demand, where certain periods of the day require increased electricity. The supply of this marginal electricity is needed for a short time period to supplement the baseload sources. This intermittent demand is generally supplied by "peaking" sources.

To supply dependable power to consumers, utilities and state regulatory agencies and commissions responsible for energy resources routinely forecast electrical loads and balance their energy requirements against available and planned electrical generation and transmission capacity. The forecast demand is based on many factors, including the total quantity of electricity needed to serve baseload demand, peaking requirements, and seasonal variations. Forecasters must predict the rate of growth of an area's electrical demand and the availability of existing capacity and planned projects. As demand increases, utilities usually either increase capacity within their existing system or enter into power purchase agreements with other utilities or generators. Once power purchase agreements are made, suppliers will bring on line existing power plants or will construct new power plants.

2.1.1.2 <u>Region-Wide Growth in Electrical Demand</u>
In general, the economies and populations of states in the West are increasing. Population growth in 1988 was up 2 percent for the state of Washington, 1.6 percent for Oregon, 3.8 percent for Nevada, and 2.2 percent for California. Nevada and Washington led the nation in the creation of wage and salary jobs in the first quarter of 1989, while Oregon was in fourth place (Economic Outlook Center 1989). The population and economic expansion will require additional electricity, for supplying the needs of more consumers as well as for meeting trends of increasing rates of electrical use.

For example, California experienced a peak growth in electrical demand of less than one percent per year from 1980 to 1983, which expanded to 2.7 percent per year from 1983 to 1987. The California Energy Commission projects that annual electricity demand growth will be 2.1 percent statewide over the next decade. Population increases are estimated to account for 70 percent of future increases, while increasing per capita energy use accounts for the remainder. The latter includes increased electrical use by commerce and commercial consumers that has outpaced recent expectations. Growth in this sector has included the addition of new businesses to expanding statewide economies and the use of more energy-intensive equipment in existing businesses (California Energy Commission 1989).

Similar to the trend in California, electricity consumption in the Western Systems Coordinating Council[a] area (which generally includes the area from eastern Colorado to the Pacific Ocean) is expected to grow approximately 21 percent between 1987 and 1997 (North American Electric Reliability Council 1988). An increasing growth in demand for power includes the return of energy-intensive manufacturing in the Pacific Northwest (Egan 1989), and the setting of record summer peak demands in 1988 and 1989 in Arizona, Idaho, Nevada, and Utah (Electric Utility Week 1988, 1989a,b,c).

2.1.1.3 Regional Forecasts for Power Demand

A number of state regulatory agency, industrial, and utility sources indicate continued growth in electrical demand that will require additional power generation, conservation, or both. These forecasts are essential to making informed decisions regarding the need for new power generation capacity, implementation of conservation measures, increasing interregional transmission capacity, and the development of agreements between utilities and suppliers for power generation and transmission. The following subsections summarize these forecasts by the regional areas that would potentially be supplied by the proposed TSPP project.

Northwest Demand Forecasts. The Western Systems Coordinating Council is responsible for reporting information to the Federal Department of Energy on bulk power supply programs for its 40 electric power system members. The information reported includes electric capacity and demand forecasts by regional area, including the Northwest Power Pool Area that consists of northern Nevada, Utah, Oregon, Washington, Montana, Western Wyoming, and the Canadian provinces of British Columbia and Alberta. The data presented for that area show an average annual increase in forecasted demand of 1.7 percent from 1988 to 1998, based on the net annual amount of electrical energy needed to satisfy the requirements of consumers and accounting for transmission and distribution losses (Western Systems Coordinating Council 1989).

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[a] The Western Systems Coordinating Council includes 19 investor-owned utilities, 17 municipal utilities, 18 public power systems, 4 Federal agencies in the States of Nevada, California, Arizona, New Mexico, Utah, Colorado, Wyoming, Idaho, Montana, Oregon, Washington, a portion of South Dakota, and the Canadian provinces of British Columbia and Alberta.

The Intercompany Pool, a council representing eight electric utility companies[a] in the Northwest, reports forecast data on electric loads and supply resources for their members. Their analysis of available electric supply surplus versus annual electric load shows a power deficit occurring in 1991-1992, with the deficit increasing every year through 1998 (the last year of available forecasts)(Intercompany Pool 1989).

Reports from individual utilities appear to substantiate this predicted deficit. Portland General Electric's power surplus is expected to be exhausted by 1993 and Pacific Power & Light/Utah Power & Light predict the need for new power sources by 1997 (Northwest Power Planning Council 1989a). Puget Sound Power and Light has issued proposals to supply new power capacity by 1993, while the Bonneville Power Administration is requesting Southern California utilities, who purchase power in the summer, to send power to the Northwest during the winter to meet anticipated shortages (Electric Utility Week 1989a,b,c). The Northwest Power Planning Council reports that six investor-owned utilities[b] in the Northwest as a group will need new resources by 1991. At a population increase of 2 percent or more, the region is forecasted to need new resources by 1992. If the population increases by 0.9 to 1.5 percent, the need for new capacity is projected to begin in 1995 (Northwest Power Planning Council 1989b).

A potential loss of existing power sources in the Northwest could occur due to the expiration of the Canadian Entitlement Purchase Agreement. Because the Columbia River and the Bonneville Power Administration's dams are fed by waters originating in Canada, this agreement stipulates that a portion of the power produced by the dams belongs to Canada. To date, Canada has not needed the power and has allowed the Bonneville Power Administration to use it in return for power produced in the future. However, the agreement allows the U.S. share of power to return to Canada beginning in 1998 and BC Hydro of Western Canada has indicated a desire to "repatriate" the entitlement to meet Canada's future domestic loads. BC Hydro is seeking new sources of power which could be exported to the U.S., although the changes could affect power supplies in the Northwest (Washington State Energy Office 1989).

<u>California Demand Forecasts</u>. As noted above, the State of California predicts a steady growth in power demands through the next decade due to population and economic increases and a trend in increased use of electricity by commerce. The California Energy Commission's analysis of

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[a] Idaho Power Company, Montana Power, Pacific Power & Light, Portland General Electric, Puget Sound Power & Light, Utah Power & Light, Washington Water Power, and Sierra Pacific Power

[b] Idaho Power Company, Montana Power, Pacific Power & Light, Washington Water Power, Portland General Electric, and Puget Sound Power & Light

system capacity and energy requirements indicates that statewide existing and committed resources are sufficient to meet electricity needs until 1994. The addition of planned nondeferrable power supply resources (defined as future cost-effective resources that should be built and should not be replaced by other resource additions) delay the predicted deficit until 1997. The Commission's analysis of energy needs with nondeferrable resources indicates deficits of 3300 megawatts (MW) in 1999 and 13,300 MW in 2007. Consideration of pending resource additions (supply resources that are planned but do not have local, state, or Federal regulatory approval) extend the first year of the deficit to 1998. An additional 800 MW in 1999 and 10,800 MW in 2007 are necessary to accommodate this growth (California Energy Commission 1989).

Within the state, the northern California area and the portion of southern California served by Southern California Edison are not predicted to have electricity supply deficits until 1998, with nondeferrable resources included in the analysis. If pending resources are included, the deficit would not occur until the period 2000 to 2007. However, the southern California areas served by San Diego Gas and Electric and the Los Angeles Department of Water and Power are predicted to have deficits as early as 1994 and 1995, respectively. The construction of all pending resources only extends the period until a deficit occurs to 1995 (California Energy Commission 1989).

Out-of-state power purchases have provided a major contribution to California's energy supplies since 1987 and are expected to continue to do so. In 1987, 15 percent of the state's power was provided by imports from the Pacific Northwest, the Southwest, Canada, and Mexico. The California Energy Commission reports that the various types of electric power from out-of-state sources is supplied at reasonable cost, and the state's energy needs are compatible with other regions. For example, California's peak energy demands occur during the summer, while the Northwest region's peak period occurs during the winter, which allows California and the Northwest to exchange power at different times of the year without it significantly affecting their respective generation capacities. Expansion of transmission capacity in the future will allow for greater access to the California energy market, and will encourage intra- and inter-state competition (California Energy Commission 1989).

Nevada Demand Forecast. Nevada has experienced growth from overall population and economic expansion and has also been affected by above average growth spurts in some economic sectors since 1983-1984. Growth in demand within Sierra Pacific Power Company's (SPPC's) service area is forecast by the utility to be 4.5 percent per year through 1994, and 1.6 percent per year from 1994 to 2008. Sharp increases in expected demand are associated with expansion in actual and planned construction of mines in northern Nevada (SPPC 1989). The Nevada Power Company has experienced an annual load growth rate of 6.7 percent over the past four years, and predicts 2.8 percent per year growth over the next 20 years. Recent growth in demand has been attributed largely to the rapid expansion of the hotel-

resort industry in southern Nevada, and business relocations to the Las Vegas area (Nevada Power Company 1988).

Electric resource plans are prepared by utilities in Nevada every two years. These plans include data on forecasted electric need and available or planned generation capacity. The plans (prior to being finalized) are reviewed by the Nevada Public Utilities Commission and the State Office of Consumer Advocacy. The resource plan for SPPC shows that power need will increase through 2008/2009, and will be met through imported power from other states and capacity additions (SPPC 1989). The 1988 Resource Plan for Nevada Power Company indicates a total load requirement (with conservation considered) of just under 2000 MW in 1988, increasing steadily to approximately 3000 MW in 2005. To meet demand, plans identify the need for expansion of transmission capacity to permit the utility to purchase more power from other utilities (NPC 1988). The following shows the forecast loads and resources for SPPC and Nevada Power Company, based on their 1989 electric resource plans:

	1990	1995	2000	2005	2008
Sierra Pacific Power Company					
Load Requirements (MW):	1124	1296	1390	1487	1573
Available Capacity (MW)[a]:	1085	1160	1085	1070	1070
Short-term Purchase (MW):	39	0	0	0	0
Needed Capacity (MW):	0	136	305	417	503
Nevada Power Company[b]					
Load Requirements (MW):	2000	2250	2500	2800	N/A
Available Capacity (MW):	1800	1800	1800	1800	N/A
Needed Capacity (MW):	200	450	700	1000	N/A

2.1.2 NEED FOR POWER TRANSMISSION FACILITIES

New electric transmission systems are not part of this proposed action. However, it is recognized that electrical transmission systems would be needed to transmit the electricity from the proposed TSPP facility to the market areas. This section discusses the need for potential new transmission systems.

The need for electricity in future years in any given area in the Western U.S. will likely be met in part by the import of power from other

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a Available capacity for SPPC includes imported power from Utah Power & Light, Idaho Power, and Pacificorp, and the addition of new qualifying facilities to the resource base.

b Loads and capacities are approximate. Data are not forecast for the year 2008.

regions. As previously noted, power purchases and exchanges between states, utilities, and investor-owned utilities are currently made on a routine basis (in accordance with Federal and state review and approval), and are expected to be important in meeting predicted needs. These exchanges are made possible by a complex transmission network in the West, which is shown on Figure 2.1-1. The ability of power exchanges to be made in the future may be limited by the capacity of available transmission facilities.

Present regulations allow public utilities to generate, transmit, and distribute electricity to purchasers, and to build, own, and operate all of the required facilities. However, independent power producers, such as the TSGC, are allowed only to build power plants and to generate electricity. There are no regulations in place which allow for them to build or operate facilities to transmit or distribute electricity. Therefore, independent power procedures need to contract with utilities to distribute their electricity. For the proposed project, Sierra Pacific Power Company would be the utility that would arrange for distribution of the electricity from the plant.

A number of alternatives are potentially available for interconnecting TSPP with the existing and future regional transmission systems. As previously noted, SPPC would provide transmission services from TSPP to neighboring utilities. SPPC would be responsible for arranging transmission services to the purchasing entity, and would work with neighboring utilities to develop the required transmission system. In so doing, SPPC would make use of existing and proposed related transmission projects.

One transmission project is the Southwest Intertie Project proposed by the Idaho Power Company. This project could be a potential route for power from TSPP. However, the transmission line is not specifically intended to connect to TSPP, nor would the line necessarily meet all TSPP's requirements for capacity or market interconnections. In Nevada, the project would have the capability to provide direct interconnections among Idaho Power, SPPC, and Nevada Power Company. Such interconnections would provide improved import/export capability and access to energy markets presently unavailable.

The applicant has identified three market areas in the West which TSPP could serve: the Northwest (i.e., Idaho, Oregon, and Washington), California, and Nevada. Possible scenarios on how the TSPP power could be transmitted to those market areas are described below and illustrated on Figures 2.1-1 and 2.1-2.

2.1.2.1 <u>Northwest Transmission Corridors</u>

Three alternatives have been identified by SPPC which would enable the TSPP to transmit power to the Northwest. The first alternative would be to construct a new transmission line from TSPP to SPPC's existing Midpoint-Valmy 345-kilovolt(kV) line, approximately 25 miles Northwest of the plant

Source: Adapted from Western Systems Coordinating Council (1986).

Figure 2.1-1. EXISTING AND PLANNED TRANSMISSION FACILITY NETWORK IN THE TSPP MARKET REGION

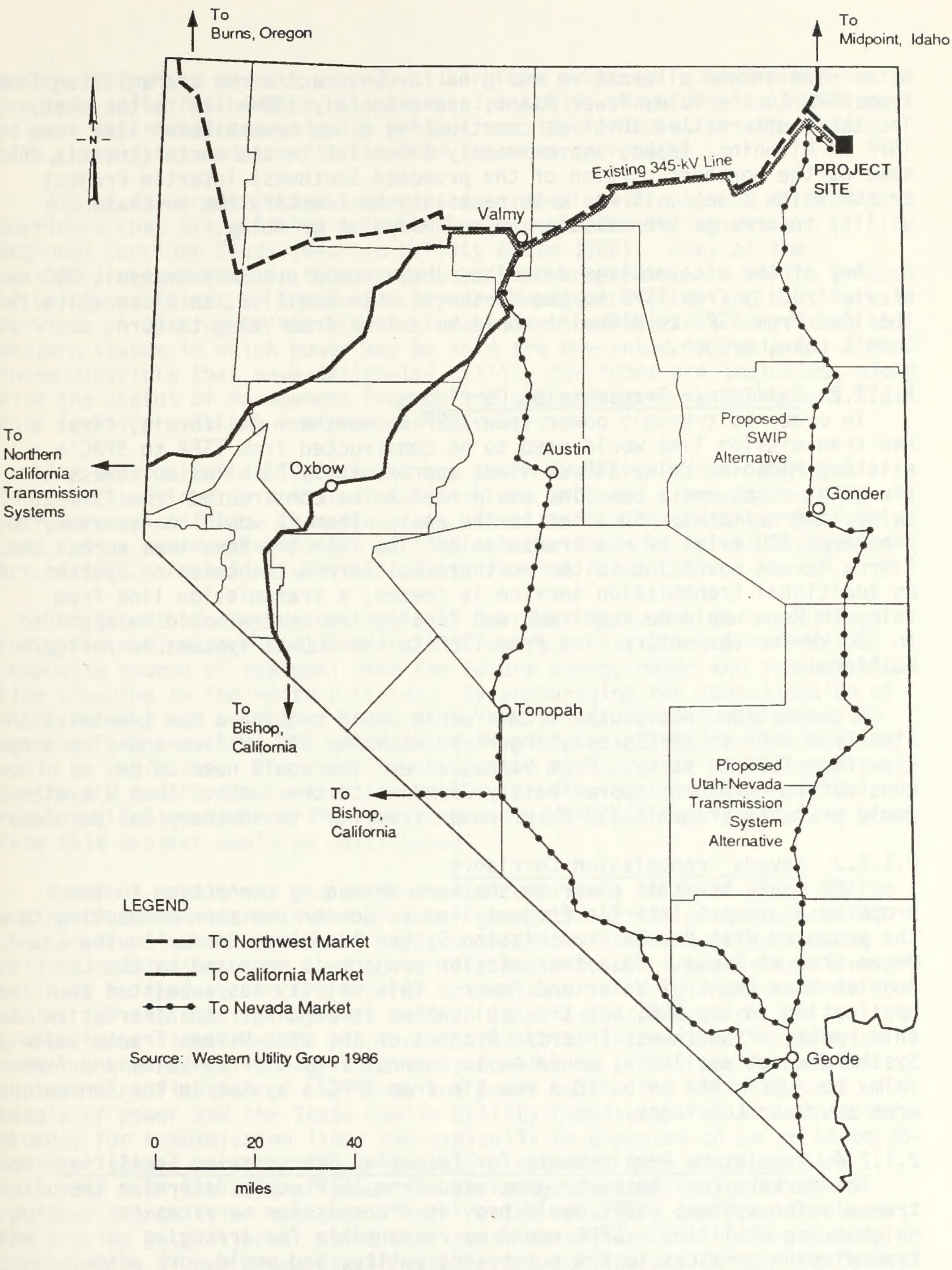

Figure 2.1-2. POTENTIAL ROUTES FOR TRANSMITTING ELECTRICITY WITHIN NEVADA

site. The second alternative would be to construct a new transmission line from TSPP to the Valmy Power Plant, approximately 150 miles to the west. The third alternative involves constructing a new transmission line from TSPP to Midpoint, Idaho, approximately 140 miles to the north (this is the same as the northern portion of the proposed Southwest Intertie Project transmission line). It would be necessary to identify the purchasing utility to arrange transmission beyond Midpoint or Valmy.

Any of the alternatives described above could probably transmit 500 MW of electricity from TSPP to the Northwest. In addition, an alternative to the line from TSPP to Midpoint could be a line from Valmy to Burns or Summit Lake, Oregon.

2.1.2.2 California Transmission Corridors

In order to transmit power from TSPP to northern California, first a new transmission line would need to be constructed from TSPP to SPPC's existing Midpoint-Valmy 345-kV line, approximately 25 miles Northwest of the plant site, and a new line would need to be constructed from TSPP to Valmy, approximately 150 miles to the west. Then it would be necessary to construct 120 miles of new transmission line from the Reno area across the Sierra Nevada mountains to the northern California transmission systems. As additional transmission service is needed, a transmission line from Valmy to Reno would be required, and finally the system would be upgraded to 500 kV for the entire line from TSPP to the 500-kV systems in northern California.

A connection into southern California would require a new transmission line from TSPP to SPPC's existing Midpoint-Valmy 345-kV line and also a new line from TSPP to Valmy. From Valmy, a new line would need to be constructed to Oxbow, approximately 75 miles to the south. Such a system could probably transmit 250 MW of power from TSPP to southern California.

2.1.2.3 Nevada Transmission Corridors

TSPP could transmit power to southern Nevada by connecting to the proposed Southwest Intertie Project line to Gonder and then connecting to the proposed Utah-Nevada Transmission System line from Gonder to the Las Vegas area at Geode. This transmission project is proposed by the Los Angeles Department of Water and Power. This utility has submitted an application to the BLM, but the application is pending. An alternative to this route, if Southwest Intertie Project or the Utah-Nevada Transmission System are not available, would be to connect from TSPP to Valmy and from Valmy to Austin and to build a new tie from SPPC's system in the Tonopah area south to Las Vegas.

2.1.2.4 Regulatory Requirements for Potential Transmission Facilities

The markets for the power generated from TSPP would determine the transmission system. SPPC would provide transmission services to neighboring utilities. SPPC would be responsible for arranging transmission services to the purchasing entity, and would work with neighboring utilities to develop the required transmission system. In so

doing, SPPC plans to make use of existing and proposed related transmission projects. The full impact of transmission would, therefore, be addressed as each individual transmission project was identified as to appropriate size, necessity, and benefit based on the power purchaser.

All of the transmission scenarios described above make use of utility corridors that are existing or have been recommended in the Western Regional Corridor Study (Western Utility Group 1986). Many of the corridors recommended in that study have been adopted or are in the process of being considered by the Bureau of Land Management (BLM) and U.S. Forest Service. A listing of the BLM and Forest Service Districts comprising the Western states in which power may be sold are presented in Table 2.1-1. Those districts that have designated utility corridors are indicated, along with the status of Management Framework Plans and Resource Management Plans that identify existing and proposed corridors.

The information in Table 2.1-1 was taken from the Western Regional Corridor Study and is a list of existing and proposed transmission line corridors as of 1986. This study was undertaken in response to the Federal Land Policy and Management Act of 1976 and the National Forest Management Act of 1976. This list will be updated for the Final EIS.

The intent of the Western Regional Corridor Study was to consolidate energy transmission plans, current and future. This study provides a composite source of regional data for future energy needs and transmission line planning in the Western states. By encouraging the consolidation of rights-of-way and promoting cooperation and policy consistency among the agencies and industry, the potential for multiple and duplicative corridors would be minimized. The study has been used for corridor planning purposes by the BLM and Forest Service throughout the five Western states. The resulting designated corridor system provides the pathways over which power from this project could be distributed.

Numerous regulatory and environmental approvals would be required for any purchase and transmission of power generated by the project, and for the construction or upgrade of any transmission facilities. Each state utility commission would need to certify any proposed transmission line and may have to approve the transfer or transmission of electricity within a state. If the electricity were sold in interstate commerce or the transmission line from the plant connected to an interstate transmission network, the Federal Energy Regulatory Commission (FERC) would need to approve certification of the lines and power sale. The FERC sale and resale of power and the State Public Utility Commission review and decision process for transmission lines can typically be expected to be an 18 to 36-month or longer period. These regulatory agencies have discretionary authority over the sale of power and the selection and design of new or upgraded transmission systems. Their review considers the need for power, the pricing rate of power sales and transmission, and the environmental consequences of new transmission systems and corridors. During the Federal and state review period, opportunities are provided for intervention and

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a]

State/Agency	Corridor Designation	Plan Status[b]
CALIFORNIA		
Bureau of Land Management		
Bakersfield District		
Bishop RA[c]	Designates Corridors	Final 1/83
Caliente RA[c]	Does Not Designate Corridors[d]	Final 9/85
Folsom RA	Does Not Designate Corridors[d]	Draft 12/86, Final 3/87
Hollister RA	Designates Corridors	Final 8/84
California Desert District	Designates Corridors	Final 12/80
Susanville District		
Alturas RA	Does Not Designate Corridors[d]	Draft 4/83, Final 8/84
Eagle Lake RA[c]	Does Not Designate Corridors[d]	Final 8/82
Surprise RA[c]	Designates Corridors	Final 4/81
Ukiah District		
Arcata RA	Does Not Designate Corridors[d]	Draft 3/87, Final NA
Clear Lake RA	Does Not Designate Corridors[d]	Final 10/84
Redding RA	Does Not Designate Corridors[d]	Final 12/82
U.S. Forest Service		
Angeles NF	Designates Corridors	Draft 5/85, Final 2/87
Cleveland NF	Does Not Designate Corridors[d]	Final 6/86
Eldorado NF	Does Not Designate Corridors[d]	Draft 8/86, Final 7/87
Inyo NF	Does Not Designate Corridors[d]	Draft 10/86, Final 8/87
Klamath NF	Does Not Designate Corridors[d]	Draft 2/87, Final NA
Lassen NF	Does Not Designate Corridors[d]	Draft 5/86, Final NA
Los Padres NF	Does Not Designate Corridors[d]	Draft 7/86, Final NA
LTBMU	Does Not Designate Corridors[d]	Draft 3/86, Final 6/87

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a] (continued)

State/Agency	Corridor Designation	Plan Status[b]
CALIFORNIA (cont.)		
U.S. Forest Service (cont.)		
Mendocino NF	Does Not Designate Corridors[d]	Draft 9/86, Final 2/87
Modoc NF	Designates Corridors	Draft 4/87, Final NA
Plumas NF	Does Not Designate Corridors[d]	Draft 1/86, Final NA
San Bernardino NF	Does Not Designate Corridors[d]	Draft 4/86, Final 9/87
Sequoia NF	Does Not Designate Corridors[d]	Draft 11/85, Final NA
Shasta-Trinity NF	Does Not Designate Corridors[d]	Draft 8/86, Final NA
Sierra NF	Does Not Designate Corridors[d]	Draft 9/86, Final NA
Six Rivers NF	Does Not Designate Corridors[d]	Draft 12/86, Final NA
Stanislaus NF	Does Not Designate Corridors[d]	Draft 11/85, Final NA
Tahoe NF	Designates Corridors	Draft 1/86, Final 11/87
IDAHO		
Bureau Of Land Management		
Boise District		
Bruneau RA	Designates Corridors	Final 6/83
Cascade RA	Does Not Deisgnate Corridors[d]	Draft 8/86, Final 11/87
Jarbidge RA	Does Not Designate Corridors[d]	Draft 8/84, Final 1/87
Owyhee RA	Designates Corridors	Final 5/81
Burley District		
Deep Creek RA	Does Not Designate Corridors[d]	Final 2/81
Snake River RA[c]	Does Not Designate Corridors[d]	Final 1/86
Coeur d'Alene District[c]	Does Not Designate Corridors[d]	Final 11/81
Idaho Falls District	Does Not Designate Corridors[d]	Draft 2/87, Final 10/87

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a] (continued)

State/Agency	Corridor Designation	Plan Status[b]
IDAHO (cont.)		
Bureau of Land Management (cont.)		
Salmon District		
Challis RA[c]	Does Not Designate Corridors[d]	Final 9/83
Lemhi RA	Does Not Designate Corridors[d]	Final 7/86
Shoshone District[c]	Does Not Designate Corridors[d]	Final 9/85
U.S. Forest Service		
Boise NF	Does Not Designate Corridors[d]	Draft 4/87, Final N/A
Cache NF	Does Not Designate Corridors[d]	Final 10/85
Caribou NF	Does Not Designate Corridors[d]	Final 9/85
Challis NF	Does Not Designate Corridors[d]	Draft 10/85, Final 6/87
Clearwater NF	Does Not Designate Corridors[d]	Draft 5/85, Final 6/87
Curlew NG	Does Not Designate Corridors[d]	Final 10/85
Nez Perce NF	Does Not Designate Corridors[d]	Draft 1/85, Final 3/87
Panhandle NFs	Does Not Designate Corridors[d]	Draft 4/85, Final 5/87
Payette NF	Designates Corridors	Draft 8/85, Final 5/88
Salmon NF	Does Not Designate Corridors[d]	Draft 10/85, Final 1/87
Sawtooth NF	Designates Corridors	Draft 11/85, Final 9/87
Targhee NF	Designates Corridors	Final 10/85
NEVADA		
Bureau of Land Management		
Battle Mountain District		
Shoshone-Eureka RA	Designates Corridors	Final 2/86
Tonopah RA		
(Esmeralda County)	Designates Corridors	Final 10/86
(No. Nye County)	Designates Corridors	Final 6/81

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a] (continued)

State/Agency	Corridor Designation	Plan Status[b]
NEVADA (cont.)		
Bureau of Land Management (cont.)		
Carson City District		
Lahontan RA	Designates Corridors	Final 12/85
Walker RA	Designates Corridors	Final 6/86
Elko District	Designates Corridors	Draft 8/85, Final 1/87
Ely District[c]	Designates Corridors	Final 6/83
Las Vegas District		
Caliente RA	Designates Corridors	Final 2/82
Stateline RA		
(Clark County	Does Not Designate Corridors[d]	Final 1/84
(So. Nye County)	Designates Corridors	Final 10/86
Winnemucca District	Designates Corridors	Final 7/82
U.S. Forest Service		
Humboldt NF	Designates Corridors	Final 8/86
Toiyabe NF	Designates Corridors	Final 6/86
OREGON		
Bureau Of Land Management		
Burns District[c]	Designates Corridors	Final 8/85
Coos Bay District	Designates Corridors	Final 4/83
Eugene District	Designates Corridors	Final 9/83
Lakeview District[c]	Designates Corridors	Final 1/83

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a] (continued)

State/Agency	Corridor Designation	Plan Status[b]
OREGON (cont.)		
Bureau of Land Management (cont.)		
Medford District[c]	Designates Corridors	Final 10/80
Prineville District[c]	Designates Corridors	Final 2/85
Roseburg District	Designates Corridors	Final 9/83
Salem District[c]	Designates Corridors	Final 12/83
Vale District[c]	Designates Corridors	Draft 4/86, Final 2/87
U.S. Forest Service		
Crooked River NG	Designates Corridors	ROD[e] 8/89
Deschutes NF	Does Not Designate Corridors[d]	Draft 1/86, NOA[f] 6/90
Fremont NF	Designates Corridors	Final 5/89
Malheur NF	Does Not Designate Corridors[d]	Draft 8/87, NOA 6/90
Mt. Hood NF	Does Not Designate Corridors[d]	Draft 1/88, NOA 7/90
Ochoco NF	Does Not Designate Corridors[d]	ROD 8/89
Rogue River NF	Does Not Designate Corridors[d]	Draft 12/87, NOA 6/90
Siskiyou NF	Does Not Designate Corridors[d]	ROD 3/89
Siuslaw NF	Does Not Designate Corridors[d]	Draft 11/86, NOA 1/90
Umpqua NF	Does Not Designate Corridors[d]	Draft 1/88, NOA 2/90
Wallowa-Whitman NF	Designates Corridors	Draft 3/86, NOA 2/90
Willamette NF	Does Not Designate Corridors[d]	Draft 12/87, NOA 4/90
Winema NF	Designates Corridors	Draft 12/87, NOA 5/90

Table 2.1-1. USFS AND BLM TRANSMISSION AND UTILITY CORRIDOR DESIGNATION INVENTORY[a] (concluded)

State/Agency	Corridor Designation	Plan Status[b]
WASHINGTON		
Bureau Of Land Management		
Spokane District	Designates Corridors	Draft 8/85, Final 3/87
U.S. Forest Service		
Colville NF	Does Not Designate Corridors[d]	ROD 12/88
Gifford Pinchot NF	Does Not Designate Corridors[d]	Draft 9/87, NOA 7/90
Mt. Baker-Snoqualmie NF	Does Not Designate Corridors[d]	Draft 1/88, NOA 2/90
Okanogan NF	Designates Corridors	Draft 3/86, NOA 12/89
Olympic NF	Does Not Designate Corridors[d]	Draft 11/86, NOA 9/90
Umatilla NF	Does Not Designate Corridors[d]	Draft 11/87, NOA 1/90
Wenatchee NF	Designates Corridors	Draft 6/86, NOA 1/90

a Current as of December 1986.

b Information provided by individual agency administrative units. Date of issuance for Draft and Final Management Plans is indicated where known; NA means date not available or unknown as of December 1986.

c Multiple plans, most current plan identified.

d Alternate facility planning tools have been implemented, such as identifying Areas of Environmental Concerns and topographic constraints.

e ROD - Record of Decision with current date.

f NOA - Notice of Availability (of final report) with projected date.

Source: Adapted from Western Utility Group 1986

comment by concerned Federal, state, and local government agencies and private groups and individuals. Potentially, any Federal, state, or local agency with jurisdiction over affected lands or resources, or other affected party, can take part in the review process. Table 2.1-2 details potential major Federal and Nevada, California, Oregon, Washington, and Idaho state permits that might be required for construction and operation of transmission facilities leading to the electrical market areas served by TSPP. The need for permit approval by each of the agencies listed in the tables would be determined when power purchase arrangements had been made with a utility and after the means of electric power transmission were identified. These tables identify the major licensing requirements.

Physical and jurisdictional constraints also affect the transfer or transmission of power and any new transmission systems. The capability to transmit power is limited by the available capacity of existing systems. New transmission systems would have to avoid certain lands, such as wilderness areas, National Parks, and areas where transmission lines would conflict with existing or planned land uses. Established utility corridors may also be at capacity, being occupied by other existing utilities such as water, gas, and petroleum product pipelines, highways, communication lines (fiber optic and telephone cables), and electric transmission lines. In these situations, the agencies reviewing the application for the transmission of power or new transmission systems would have to conduct extensive evaluation of the effect of widening an existing utility right-of-way or permitting a new corridor.

2.2 SITE REQUIREMENTS

Private land in the Toano Draw area was purchased in 1980 after siting studies indicated the suitability of the property for the location of a public utility coal-fired electric generating plant. Title to those lands which were required for the power plant are now held by Thousand Springs Generating Company (TSGC), an independent power producer. Other lands are needed in the project area and they remain to be acquired by TSGC through this proposal or alternatives. These lands involve a checkerboard pattern with ownership alternating between public lands managed by the Federal government and private entities.

The proposed TSPP and ancillary facilities (i.e., access road, wellfields, wastewater evaporation ponds, ash disposal area, coal storage area, and railroad corridor) would occupy approximately 1780 acres of land area upon full development. Much of the land area would need to be contiguous to efficiently construct and operate a facility of this size. Therefore, use of some of the land in the Toano Draw area presently managed by the BLM would be required to construct and operate a power plant. There are three mechanisms by which to acquire legal use of public land for a project of this type: land exchange, land sale, or right-of-way grants. Each of these mechanisms is considered in this analysis.

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
FEDERAL				
National Environmental Policy Act (NEPA) Compliance	Granting of ROW Over Land Under Federal Jurisdiction for Implementation of Project	Lead Agencies - BLM; Cooperating Agencies	EIS and Record of Decision	NEPA
Right-of-Way (ROW) Over Land Under Federal Management	Construction, Operation, and Abandonment	Bureau of Land Management (BLM)	Grant of ROW	Federal Land Policy and Management Act
		Bureau of Indian Affairs	Grant of ROW over Indian Lands	25 CFR 169
		U.S. Forest Service (USFS)	Special Use Authorization Permit, or Easement	36 CFR 251
		Army Corps of Engineers (COE)	General Easement Required for Installation on COE/Military Land	10 USC 2668, 2669 43 USC 961
		National Park Services (NPS) Lake Mead National Recreation Area (LMNRA)	Authorization to Cross LMNRA Lands	Title 18 USC, 36 CFR 14
		USFWS	Special Use Permit for Crossing a National Wildlife Refuge	50 CFR 25

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
FEDERAL (cont.)				
		National Park Service	Review of Transmission Line Corridor, to Identify Conflicts with Recreational area Reserved with Monies from the Land and Water Conservation Fund Act	Land and Water Conservation Fund Act P.L. 88-578
	Construction, operation and abandonment of transmission lines across or within highway ROWs		Compliance with Section 4 (f) Department of Transportation Act	23 CFR 771
Water Resources	Construction Across Streams and Rivers	COE	General Easement	10 USC 2668, 2669 40 USC 961
	Discharge of Dredge and Fill Materials	COE	404 Permit (Individual or Nationwide)	Clean Water Act
	Placement of Structures and Work in Navigable Waters	COE	Section 10 Permit	River and Harbors Act
	Protection to all Rivers Included in the National Wild and Scenic Rivers Systems	All Federal Agencies	Review by Permitting Agencies	Wild Scenic Rivers Act P.L. 90-542 43 CFR 83.50

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
FEDERAL (cont.)				
Biological Resources	Grant of ROW by Federal Land Management Agency	Fish and Wildlife Service	Endandered Species Act Compliance by Federal Land Management Agency and Lead Agency	Endangered Species Act, Section 7
	Protection of Migratory Birds		Migratory Bird Treaty Act	16 USC 703-711 50 CFR Ch 1 FR Vol. 40, No. 231
	Grant of ROW by Federal Land Management Agency Involving Aquatic Habitats	Lead Federal Agency	Fish and Wildlife Coordination Act Compliance by Federal Land Management Agency and Lead Agency	Fish and Wildlife Coordination Act
Cultural Resources	Grant of Right-of-Way by Federal Land Management Agency	BLM, USFS, Advisory Council on Historic Preservation, Inter-agency Archeological Service	National Historic Preservation Act Compliance by Federal Land Management Agency and Lead Agency	National Historic Preservation Act, Section 106
		All	Emergency Procedures for Cultural and Historic Properties Discovered During Construction	Archeological and Historic Preservation Act (AHPA) Public Law 93291
		All	Protection and Preservation of Native American Religious and Cultural Rights and Practices	American Indian Religious Freedom Act (AIRFA)

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
FEDERAL (cont.)				
Cultural Resources (cont.)	Protection to segments, sites, and features related to the California Emigrant Trail in Thousand Springs Valley		National Trails System Act	P.L. 90-543 16 USC 1241-1249
Air Traffic	Notice on Location of Towers May Be Required	Federal Aviation Administration	A "No-hazard Declaration" required if structure is more than 200 feet in height	49 USCA 1501 14 CFR 77
Interconnection Facilities	Interconnection of Transmission Facilities Across State Lines	Federal Energy Regulatory Commission (FERC)	Authorization for Interconnection Across State Lines	Federal Power Act Section 202(b)
Rate Regulation	Sales for Resale	FERC	Federal Power Act Compliance by Power Seller	Federal Power Act Section 201, 205
	Power Sales to Bonneville Power Administration	FERC	Federal Power Act Compliance by Power Seller	Pacific Northwest Electric Power Planning & Conservation Act; 18 CFR 35.20

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (California)				
Regulation of Privately Owned Utilities	Construction of Electric Transmission Lines	Public Utilities Commission	Certificate of Public Convenience and Necessity[a]	The Calif. Public Utilities Code Constitution, Article EII; Rules of Practice and Procedure, Title 20, Calif. Admin. Code Chapter 1; Rules Relating to the Planning and Construction of Facilities for the Generation of Electricity and Certain Electric Transmission Facilities, Order 131-A, PUC 1977
Compliance with Applicable Laws and Standards	Construction of Electric Transmission Line	California Energy Commission	Notice of Intention, Authority to Construct	Warren-Alquist Act: Public Resources Code Section 25500 et seq. (Chapter 6, Power Facility and Site Certification, particularly applies to the NOI and AFC processes); and Site Certificate Regulations, California Energy Commission, found in Title 20, California Administrative Code,

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (California) (cont.)				
Compliance with Applicable Laws and Standards (cont.)				Section 1701 et. seq. (Subchapter 5, Site Certification.)
ROW Through State-owned Lands	Construction, Operation, and Abandonment of Facilities on State Land	State Lands Commission	Land Use Lease	California Public Resources Code, Section 600 et. seq.
Effects to State Highway ROW or facilities	Encroachment within, under or over State Highway ROW	California Department of Transportation	Encroachment Permit	California Streets and Highways Code, Sections 660-734
California Environmental Quality Act (CEQA) Compliance	Any Major Action by Local or State Agency that Potentially Affects the Environment	Lead Agency	Environmental Impact Report (EIR) or Initial Study and Record of Decision[b]	CEQA
Air Resources	Operation of Equipment and Related Construction Activities That Introduce Pollutants into the Atmosphere	Air Pollution Control District	Permit to Operate (Construction Equipment)	California Health and Safety Code, Sections 39000-43834
Biological Resources	Alteration of the Natural State of Any Stream	Department of Fish and Game	Stream Alteration Agreement (1601 and 1603) during Construction	California Fish and Game Code, Sections 1600-1607

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (California) (cont.)				
Fully Protected Species	Collection or possession of designated fully protected species	Department of Fish and Game	Permit to take possession	California Fish and Game Code, Sections 3511 (birds), 4700 (mammals), 5050 (reptiles and amphibians) and 5515 (fish)
Cultural Resources	Project Construction	Office of Historic Preservation	Consultation with State Historic Preservation Officer if Significant Resources Could Be Affected	National Historic Preservation Act, Section 106; CEQA
STATE (Idaho)				
Regulation of Privately Owned Utilities	Construction of Electric Transmission Lines	Public Utilities Commission	Certificate of Public Convenience and Necessity[a]	Idaho Code Title 61. Public Utility Regulation Ch. 5 61-526
Cultural Resources	Land Disturbing Impacts	State Historic Preservation Officer	Consultation	National Historic Preservation Act, Section 106
Air Quality	Land Disturbing Impacts Generating Dust/ Particulate Emissions	Department of Health and Welfare	Rules for Control of Fugitive Dust	Department of Health and Welfare Rules and Regulations Sections 01.1251 through 01.1300

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (Nevada)				
ROW Encroachment	Encroachment into State Roadway ROW	Nevada Department of Transportation	ROW Occupancy Permit	Nevada Revised Statutes (NRS) 408.423
Ground Surface Disturbance	Project Construction	Division of Environmental Protection (NDEP)	Registration Certificate	Nevada Administration Code (NAC) 445.704
	Construction of Electric Transmission	Public Service Commission	Authority to Construct and Certificate of Need	NRS 704.330, 704.820, 704,701
Natural and Cultural Resources	Crossing State Lands	Division of State Lands	Easement onto State Lands	NRS 321.001
Air Quality	Construction and Operation	NDEP	Authority to Construct Permit to Operate	NRS 445
Rare and Endangered Plant Species	Modification of Habitat	Division of Forestry	Identification of Plant Species	
Rare and Endangered Animal Species	Protection and Management of Rare and Endangered Species	Nevada Department of Wildlife	Authority to Protect and Manage	NRS 501 NAC 503
T & E Species	Modification of Habitat	Nevada Department of Wildlife	Special Permit	NAC 5-4.510-.550

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (continued)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (Oregon)				
Regulation of Privately Owned Utilities	Construction of Electric Transmission Lines	Oregon Energy Facility Siting Council	Equivalent of Certificate of Public Convenience and Necessity[a]	Oregon Revised Statutes (ORS) Chapter 469, OAR Div. 80
Biological Resources	Alteration of Natural Stream Bed	Department of Fish and Wildlife	Review of Fill or Removal Permit Issued by State Lands Division	
Cultural Resources	Land Disturbing Impacts	State Historic Preservation Officer	Consultation	National Historic Preservation Act, Section 106
Air Resources	Land Grading Impacts (dust) if Particulate Emissions could be significant	Department of Environmental Quality	Air Contaminant Discharge Permit	ORS 340-20-155
Compliance with Regulations and Plans	Projects of state-wide significance, as defined by Land Conservation and Development Commission	Land Conservation and Development Department	Planning and Siting Permit	ORS 197.400
Alteration of a Stream Bed	Construction/Operation in Stream Beds	State Lands Division	State Permit	ORS 541.605 - 541.695 and 540.990
ROW through State Lands	Crossing State-owned Property	State Lands Division	Easement	ORS 141.65 or ORS 141.83

Table 2.1-2. SUMMARY OF POTENTIAL MAJOR PERMITS REQUIRED FOR TRANSMISSION LINE CONSTRUCTION AND OPERATION (concluded)

Issue	Action Requiring Permit, Approval, or Review	Agency	Permit, Approval, or Review	Relevant Legislation
STATE (Washington)				
Regulation of Privately Owned Utilities	Construction of Electric Transmission Lines	Washington Energy Facility Siting and Evaluation Council	Equivalent of Certificate of Public Convenience and Necessity[a]	Revised Code of Washington (RCW) 80.50
Biological Resources	Alteration of Natural Streambed	Department of Fisheries	Hydraulic Permit	RCW 75.20.100
Cultural Resources	Land Disturbing Impacts	State Historic Preservation Officer	Consultation	National Historic Preservation Act Section 106
ROW Through State Lands	ROW Through State Lands	State Lands Commission	Land Use Lease	RCW Chap. 79
Sales Agreements	Required for the Sale of Power	Utilities and Transportation Commission	Review and Approval of Interconnection of Electric Utilities	Washington Administrative Code (WAC) 480-105
Compliance with State Environmental Policy Act (SEPA)	Construction of Electric Transmission Line	Department of Ecology	Environmental Impact Statement (State)[b]	SEPA
Air Quality	Land Disturbing Impacts Generating Dust/ Particulate Emissions	Department of Ecology	Compliance with Air Quality Standards for Particulate Matter	WAC 173-400-040, 173-470

a Investor-owned utilities. To the extent there is municipal participation, the municipality must follow the state environmental guidelines for its decision to proceed or participate.
b Prepared in conjunction with NEPA EIS.

2.3 OTHER RELATED FEDERAL ACTIONS

Federal actions that could limit the construction or operation of transmission lines in Nevada, Idaho, Oregon, Washington, or California are presented in Table 2.3-1.

Table 2.3-1. OTHER RELATED FEDERAL ACTIONS

Bureau of Land Management

Arcata Resource Management Plan, CA
Barrick Goldstrick Mine Operation Plan, NV
Bennett-Hills Valley, Magic-Monument Management Framework Plan/Resource Management Plan Amendment, ID
Bishop Resource Management Plan,CA
Caliente Resource Management Plan, CA
Castle Mountain Project, CA
Chief Joseph Management Framework Plan Amendment, ID
Desert Plan Amendment, CA
Emerald Empire Management Framework Plan Amendment, ID
Fiber Optic Cable System, WY/CA
Ft. Irwin Training Center Expansion, CA
Harry Allen Power Station, NV
Lassen Geothermal Project, CA
Lost River Management Framework Plan Amendment, ID
Nellis Air Force Range Resource Management Plan, NV
Nevada Contiguous Lands Wilderness, NV
North County Landfill, San Diego County, CA
Oregon Statewide Wilderness
Owyhee Canyonlands Wilderness, OR/ID/NV
Palm Springs-South Coast Resource Management Plan, CA
Raven Management Plan, CA
Redding Resource Management Plan, CA
Small Wilderness Study Areas, ID
South Fork Eel River Watershed, CA
Southwest Intertie 500-kV Electrical Transmission Line, ID
Three Rivers Resource Management Plan, OR
Utah-Nevada Transmission System, UT/NV
White Pine Power Project, NV
Yuma District Wilderness, AZ/CA

Table 2.3-1. OTHER RELATED FEDERAL ACTIONS (continued)

United States Forest Service

Columbia River Gorge National Scenic Area, WA

Upper West Salmon Wild and Scenic River Environmental Impact Statement, WA

West Salmon Wild and Scenic River Management Plan, WA

Upper Klickitat Wild and Scenic River Environmental Impact Statement, WA

Lower Kliciktat Wild and Scenic River Management Plan, WA

Deschutes Land and Resource Management Plan, OR

Gifford Pinchot Land and Resource Management Plan, WA

Malheur Land and Resource Management Plan, OR

Meadows Ski Expansion (Mt. Hood National Park), OR

Mt. Ashland Ski Expansion (Rogue River National Forest), OR

Mt. Baker-Snoqualmie Land and Resource Management Plan, WA

Mt. Hood Land and Resource Management Plan, OR

Okanogan Land and Resource Management Plan, WA

Olympic Land and Resource Management Plan, WA

Quartz Mt. Gold Mine (Fremont National Forest), OR

Rogue River Land and Resource Management Plan, OR

Wenatchee Land and Resource Management Plan, WA

National Park Service

Eugene O'Neill National Historic Site General Management Plan, CA

Manzanita Lake Area Reopening, Volcanic National Park, CA

Santa Monica Mountains National Recreation Area Land Exchange, CA

Table 2.3-1. OTHER RELATED FEDERAL ACTIONS (concluded)

Bureau of Indian Affairs

Fish Hatchery, Nisqually Indian Reservation, WA
Ft. Mojave Indian Reservation Lease, NV
Grays Lake National Wildlife Refuge Management Plan, ID
Landfill, Composting & Recovery Facilities, Campo Indian Reservation, CA
North San Pablo Bay Wetlands Restoration, CA
San Bruno Mt. Habitat, CA
Seal Beach National Wildlife Refuge Endangered Species Protection, CA
Stephens' Kangaroo Rats Incidental Taking, CA
Tijuana Estuary Wetlands Restoration, CA
Waste Recovery and Power Plant, Tulalip Indian Reservation, WA

Bureau of Reclamation

All-American Canal, All-American Branch, CA
All-American Canal, Coachella Branch, Ca
Allen Camp Unit, Central Valley Project, CA
Arroyo Pasajero Project, CA
Arvin-Edison Water Storage & Exchange, Central Valley Project, CA
Cachuma Reservoir/Bradbury Dam Safety, CA
Columbia Basin Project, WA
Fallon Indian Reservation, Newlands Project, NV
Farmington Canal Project
Lake Berryessa Reservoir Area Managementl Plan, CA
New Melones Unit Supply, CA
New Melones Water Supply Project, CA
Offstream Storage, Los Banos Grandes, CA
Parker Division Colorado River, AZ/CA
Seawater Intrusion Project, Monterey County, CA
South Delta Water Management, CA
State Water Conveyance & Purchase, Central Valley Project, CA

3.0 PROPOSED ACTION AND ALTERNATIVES

This section provides a description of the proposed action and alternatives considered for the Thousand Springs Power Plant (TSPP). Section 3.1 describes the proposed action for land acquisition, construction, and operation of the power plant. In Section 3.2, a description of the alternatives to the proposed action carried forward for detailed analysis and those eliminated from further detailed analysis is provided. Finally, in Section 3.3, a summary of the environmental impacts and recommended mitigation measures for the proposed action and alternatives is provided.

All aspects of the proposed action and alternatives presented in this EIS would be in compliance with Federal, state, and local laws and regulations.

3.1 DESCRIPTION OF THE PROPOSED POWER PLANT PROJECT

The proposed action consists of three components: a land exchange, construction of a power plant complex, and operation of the power plant complex. The applicant proposes to exchange land with the Bureau of Land Management (BLM) for the purpose of consolidating a contiguous block of private land on which the power plant complex could be constructed and operated. The power plant complex would consist of eight 250-megawatt (MW) steam-electric generating units and associated ancillary facilities. Each unit is planned to be constructed one unit at a time at approximately 2-year intervals; however, timing for construction would be based on market demand. Construction of the first unit would begin in 1991 and be completed in 1994. Construction of the eighth unit is anticipated to begin in 2005 and be completed in 2008. Approximately 1780 acres of land would be disturbed at the power plant site, access road, railroad spur, and water pipeline upon completion of development. The construction workforce would peak at 800 workers in 1993.

Coal would be the fuel for the steam-electric generating units. Coal would be delivered by train from mines at Kemmerer (Wyoming) and Scofield (Utah). Each unit would require one 55-car unit train to be delivered every 5 days from the Scofield mine, and every 4 days from the Kemmerer mine. Four to five 55-car unit trains would deliver coal per day to the plant site with eight units operating. Operation of the power plant would also require approximately 32,000 acre-feet/year (ac-ft/yr) of water to be used primarily for cooling plant equipment. Air emissions from the plant

would be controlled by Best Available Control Technology (BACT).[a] The presently proposed BACT system is a lime spray dryer scrubber system (to reduce sulfur dioxide), a Low-NO_x burner (to reduce nitrous oxides), and a baghouse (to collect particulates). The definition of BACT would be determined for each steam-electric generating unit as they are proposed, prior to being permitted and developed. Approximately 560 workers would be required to operate the plant upon completion of all eight units. Each unit would be designed to operate for 35 years, with the first unit beginning operation in 1994 and the eighth unit ending operation in 2043. A detailed description of the three project components is provided below.

3.1.1 LAND ACQUISITION

The proposed action relative to land acquisition is to conduct a land exchange between the Thousand Springs Generating Company (TSGC) and the BLM. TSGC has selected approximately 15,960 acres of public lands in Toano Draw and offered, in exchange, approximately 12,770 acres of private land in the Snake Mountains and 640 acres of private land in Toano Draw. Table 3.1-1 lists the legal descriptions and acreages of the selected (public) lands involved in the exchange. Table 3.1-2 lists the legal descriptions and acreages of the offered (private) land involved in the exchange. Figure 3.1-1 illustrates the location of the lands involved in the exchange. Once the land exchange is consummated, the selected lands would become private and would be owned by TSGC, and the private lands would become public and would be administered by the BLM.

The exact lands and acreage that would be exchanged are based on "equal value," as determined by a fair-market appraisal approved by the BLM. Should the appraisal reflect a difference in value between the offered lands and the selected lands, acreage would have to be adjusted or monetary compensation made to equal those values. Compensation, however, cannot exceed 25 percent of the total appraised value of the public lands. If the offered lands are found to have a higher value than the selected lands, some of the offered lands would have to be dropped from the exchange proposal.

The proposed exchange would proceed on a surface-estate-only basis (i.e., mineral rights to the lands would not be exchanged). Existing access would be reserved to enable BLM to continue to administer the public lands in the Toano Draw area, and allow public access in all but the immediate project area. TSGC would grant the BLM easements for those existing access roads rerouted around the project site. Relocated access

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[a] BACT is a Clean Air Act requirement for major sources proposing to locate in clean air areas, such as the proposed TSPP. BACT is an emission limitation based on the maximum degree of reduction that the permitting authority (i.e., the NDEP) determines, on a case-by-case basis, is achievable considering energy, environmental and economic impacts and other costs (40 CFR 52.2).

Table 3.1-1. SELECTED LANDS - PUBLIC LANDS SELECTED BY THOUSAND SPRINGS GENERATING COMPANY

Legal Description	Acreage
Mount Diablo Baseline and Meridian	
T. 41 N., R. 64 E.	
sec. 24, $N\frac{1}{2}$, $SW\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{4}$.	560
T. 39 N., R. 65 E.	
sec. 24, All;	640
sec. 26, All;	640
sec. 34, All.	640
T. 40 N., R. 65 E.	
sec. 4, All;	636.16
sec. 10, All;	640
sec. 14, All.	640
sec. 24, All;	640
sec. 36, All.	640
T. 41 N., R. 65 E.	
sec. 30, Lots 2-4, inclusive, $E\frac{1}{2}$, $E\frac{1}{2}W\frac{1}{2}$;	599.05
sec. 32, All.	640
T. 38 N., R. 66 E.	
sec. 4, All;	643.84
sec. 10, All.	640
T. 39 N., R. 66 E.	
sec. 6, All;	624.72
sec. 8, All;	640
sec. 16, All;	640.60
sec. 18, All;	640
sec. 20, All;	640
sec. 30, All;	640.28
sec. 32, All.	640
T. 40 N., R. 66 E.	
sec. 16, All;	640
sec. 18, All;	355.17
sec. 20, All;	640
sec. 28, All;	640
sec. 30, All;	382.22
sec. 32, All.	640
Total Acres Selected	15,962.04

Table 3.1-2. OFFERED LANDS - PRIVATE LANDS OFFERED TO BLM BY TSGC

Legal Description	Acreage
Mount Diablo Baseline and Meridian	
T. 41 N., R. 61 E.,	
sec. 1, Lots 1 and 2, $S\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}$	320.78
sec. 12, $N\frac{1}{2}NE\frac{1}{4}$.	80
T. 40 N., R. 62 E.,	
sec. 1, $S\frac{1}{2}N\frac{1}{2}$, $S\frac{1}{2}$;	480
sec. 2, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$;	240
sec. 3, Lots 1-8 inclusive, $S\frac{1}{2}NE\frac{1}{4}$, $N\frac{1}{2}SW\frac{1}{4}NW\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$,$E\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}$;	723.20
T. 41 N., R. 62 E.,	
sec. 4, $S\frac{1}{2}S\frac{1}{2}$;	160
sec. 5, $NW\frac{1}{4}SW\frac{1}{4}$, $S\frac{1}{2}S\frac{1}{2}$,	200
sec. 6, All;	648.40
sec. 7, All;	643.40
sec. 8, $NW\frac{1}{4}NW\frac{1}{4}$, $S\frac{1}{2}NW\frac{1}{4}$, $S\frac{1}{2}$;	440
sec. 9, $SW\frac{1}{4}SW\frac{1}{4}$;	40
sec. 10, $N\frac{1}{2}NE\frac{1}{4}$;	80
sec. 11, $N\frac{1}{2}NW\frac{1}{4}$, $SE\frac{1}{4}SE\frac{1}{4}$;	120
sec. 12, $SE\frac{1}{4}NE\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$, $S\frac{1}{2}SW\frac{1}{4}$, $N\frac{1}{2}SE\frac{1}{4}$;	240
sec. 13, $S\frac{1}{2}$;	320
sec. 14, $N\frac{1}{2}N\frac{1}{2}$;	160
sec. 15, All;	640
sec. 16, $W\frac{1}{2}E\frac{1}{2}$, $W\frac{1}{2}$, $SE\frac{1}{4}SE\frac{1}{4}$;	520
sec. 17, All;	640
sec. 18, $E\frac{1}{2}$, $E\frac{1}{2}NW\frac{1}{4}$, $NE\frac{1}{4}SW\frac{1}{4}$;	440
sec. 20, $E\frac{1}{2}$, $E\frac{1}{2}W\frac{1}{2}$, $NW\frac{1}{4}NW\frac{1}{4}$;	520
sec. 21, All;	640
sec. 22, $NE\frac{1}{4}NE\frac{1}{4}$, $SW\frac{1}{4}NW\frac{1}{4}$, $W\frac{1}{2}SW\frac{1}{4}$, $SE\frac{1}{4}SW\frac{1}{4}$;	200
sec. 23, All;	640
sec. 25, All;	640
sec. 28, All;	640
sec. 29, All;	640
sec. 32, $E\frac{1}{2}E\frac{1}{2}$, $NW\frac{1}{4}NE\frac{1}{4}$;	200
sec. 33, All.	640
T. 41 N., R. 63 E.,	
sec. 6, $SW\frac{1}{4}SE\frac{1}{4}$;	40
sec. 30, Lot 2, $NE\frac{1}{4}NE\frac{1}{4}$, $S\frac{1}{2}NE\frac{1}{4}$, $SE\frac{1}{4}NW\frac{1}{4}$;	199.46
sec. 31, All.	639.12
T. 40 N., R. 66 E.,	
sec. 11, All.	640
Total Acres Offered	13,414.36

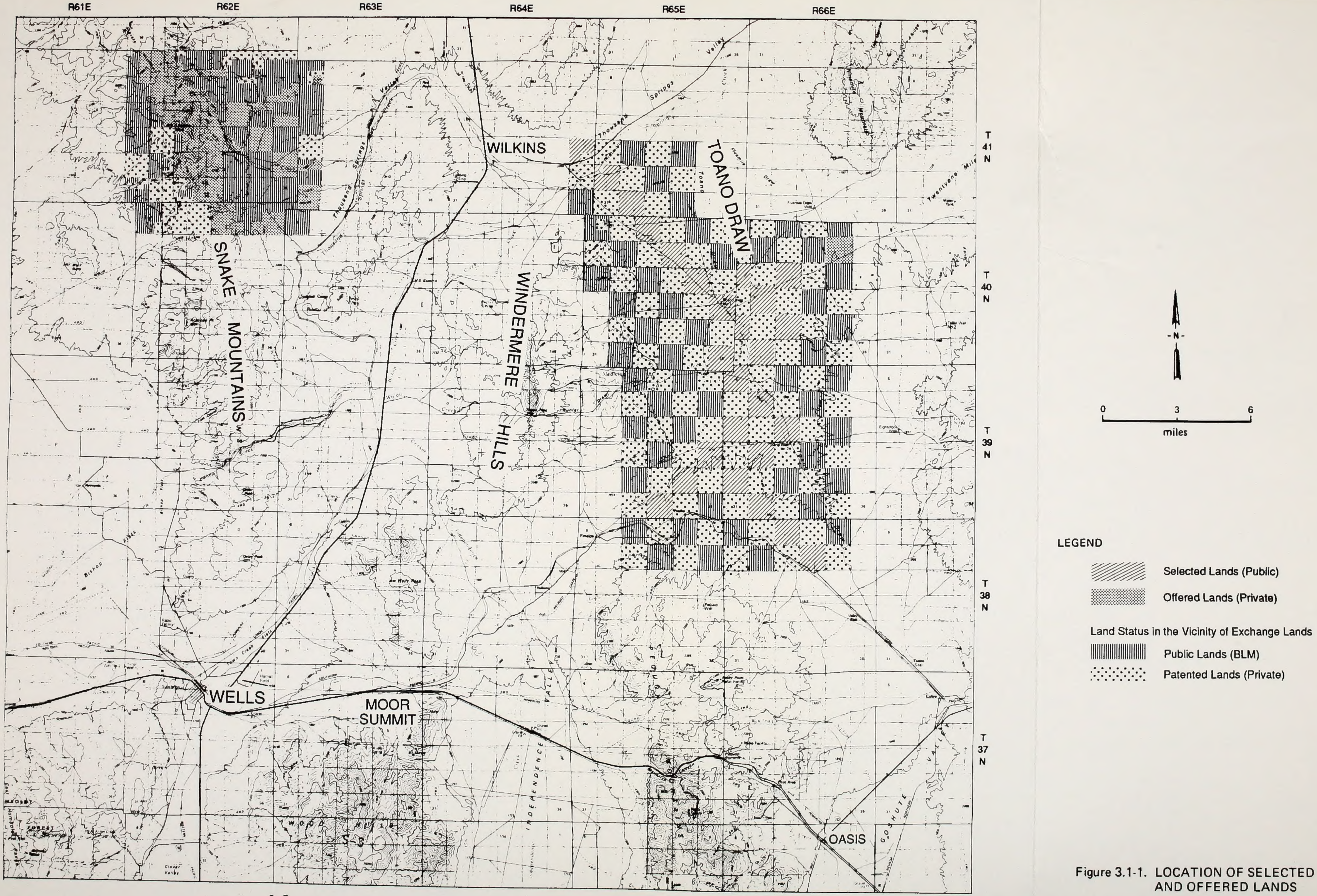


Figure 3.1-1. LOCATION OF SELECTED AND OFFERED LANDS

would be established by TSGC to the same manner and degree that presently exists.

Water rights for the upper Loomis Creek watershed in the Snake Mountains have not been adjudicated by the Nevada State Engineer. Lands of Sierra, Inc. has agreed to make application to the State Engineer to transfer a portion of their perfected irrigation rights along Thousand Springs Creek to offered lands in the upper Loomis Creek watershed. These water rights subsequently could be quitclaimed to BLM as part of the land exchange if the required water in the offered lands were unobtainable by the BLM.

3.1.2 DESIGN OF THE POWER PLANT

The TSPP electric generation complex, upon completion, would consist of eight 250-MW (nominal net) coal-fired, steam-electric generating units, designed for baseload duty but with load cycling capability. Figure 3.1-2 shows the location of the power plant and the associated ancillary facilities as proposed. A plot plan of the proposed facility is provided as Figure 3.1-3. All components would be designed and constructed in accordance with Federal and state laws, regulations, and policies.

Major components of each power generation unit would be as follows: the steam generator (boiler); turbine-generator; air emissions control system (dry scrubber and baghouse); stack; circulating water (cooling water) system; water supply, storage, and treatment facilities; waste management and disposal facilities; fuel receiving, storage, and handling facilities; plant control systems; fire protection systems; emergency power facilities; and construction-worker accommodations (Figure 3.1-3). Ancillary facilities for the plant as a whole would include access road, parking areas, railroad spur, switchyard, offices, warehouses, maintenance facilities, and temporary construction facilities (Figure 3.1-2). An 8-foot-high chain-link security fence would be provided around the main plant area. Gates would be provided at all roads and railroad entrances to the plant.

3.1.2.1 <u>Boiler</u>

The boiler (steam generator) for each unit would be a drum-type, natural-circulation, balanced-draft furnace capable of producing high volumes of steam. The boiler would be supplied with heated feedwater, and its steam output would be fed to the turbine generator.

3.1.2.2 <u>Turbine Generator</u>

The turbine generator for each unit would be a tandem-compound, single-reheat, two-flow condensing type. It would have a guaranteed nameplate rating of 267,521 kilowatts (kW).

The generator would be a direct-connected, hydrogen-cooled unit. On-site tank storage of hydrogen would be provided, with sufficient capacity to fill the generator. Carbon dioxide would be provided to purge the generator (prior to maintenance) and would be stored on site.

The turbine would consist of high-pressure and intermediate-pressure units arranged in tandem and a parallel (compound) two-flow, low-pressure unit. Steam would be extracted at various points along the flow path through the turbines, where the temperature and pressure of the steam are appropriate to supply feedwater heaters, the boiler feed pump turbine drive, and auxiliary steam header.

3.1.2.3 Air Emissions Control System

The air emissions control system for each unit would consist of best available control technology (BACT). For the first unit, the proposed BACT would consist of three components: a lime spray dryer scrubber system, low-NO_x burners, and a baghouse. The total system would be designed such that sulfur dioxide (SO_2) and nitrogen oxides (NO_x), particulate emissions would be at or below existing state and Federal regulatory requirements. BACT for each of the subsequent power generation units would be reevaluated as each unit is developed.

The SO_2 control system would be a lime-based, spray dryer type, scrubbing system. Flue gas exiting the boiler air preheater would be ducted to three spray dryer vessels. Sufficient scrubber capacity would be provided such that one spray dryer could be taken out of service for maintenance while continuing to meet the required stack emission levels with the two other units. The scrubbing medium would be a mixed slurry of slaked lime (calcium hydroxide) and recycle ash (ash recycled from the baghouse ash removal system). In addition to the spray dryer vessels, the scrubbing system would include steel, quick lime (calcium oxide) storage bins, steel recycle ash day storage bins, lime and ash feeders, lime slakers, mixing tanks, pumps, piping, controls, and auxiliary equipment. The scrubber system equipment would be contained in a building with the spray dryer vessels.

The baghouse would be installed downstream of the scrubbing system and upstream of the induced draft fans and stack. It would be designed to remove the fly ash and scrubber byproducts entrained in the flue gas leaving the scrubber, such that the emissions would not exceed 0.005 grains per actual cubic foot. This requirement ensures that the particulate emissions would not exceed the applicable regulatory requirements.

3.1.2.4 Stack

Each unit would be provided with an approximately 450-foot-high, single-flue, reinforced-concrete stack. The stack would include an 18-foot-diameter corrosion-resistant fiberglass liner. At an exit gas temperature of 140°F, it is estimated that the exit gas velocity from the stack at full load would be 3600 ft/min (60 ft/sec). A stack gas emissions monitoring system and computerized Environmental Protection Agency emissions reporting system would be provided. Emissions of SO_2, NO_x, and oxygen, and the opacity of the gas stream, would be continuously monitored and recorded.

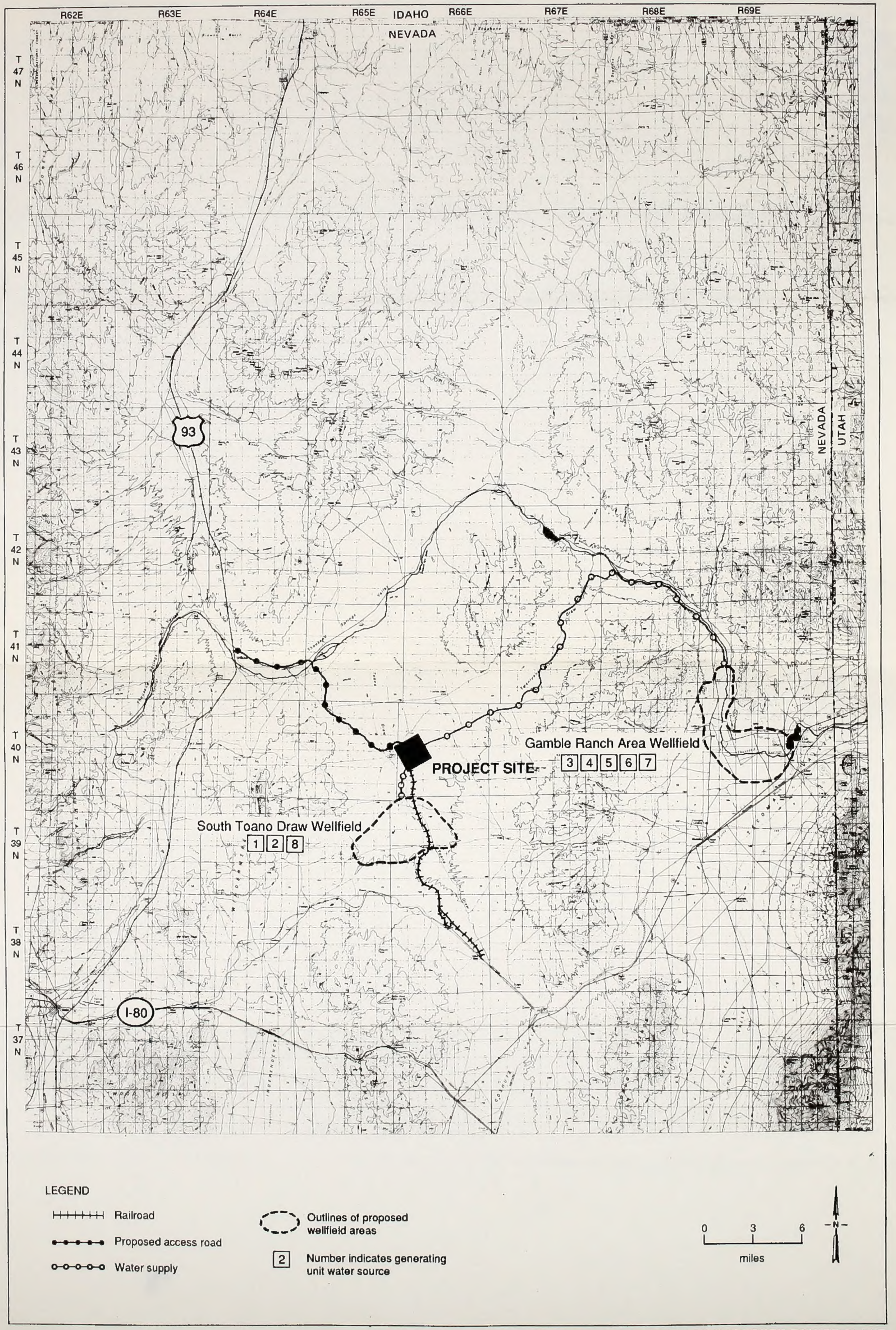
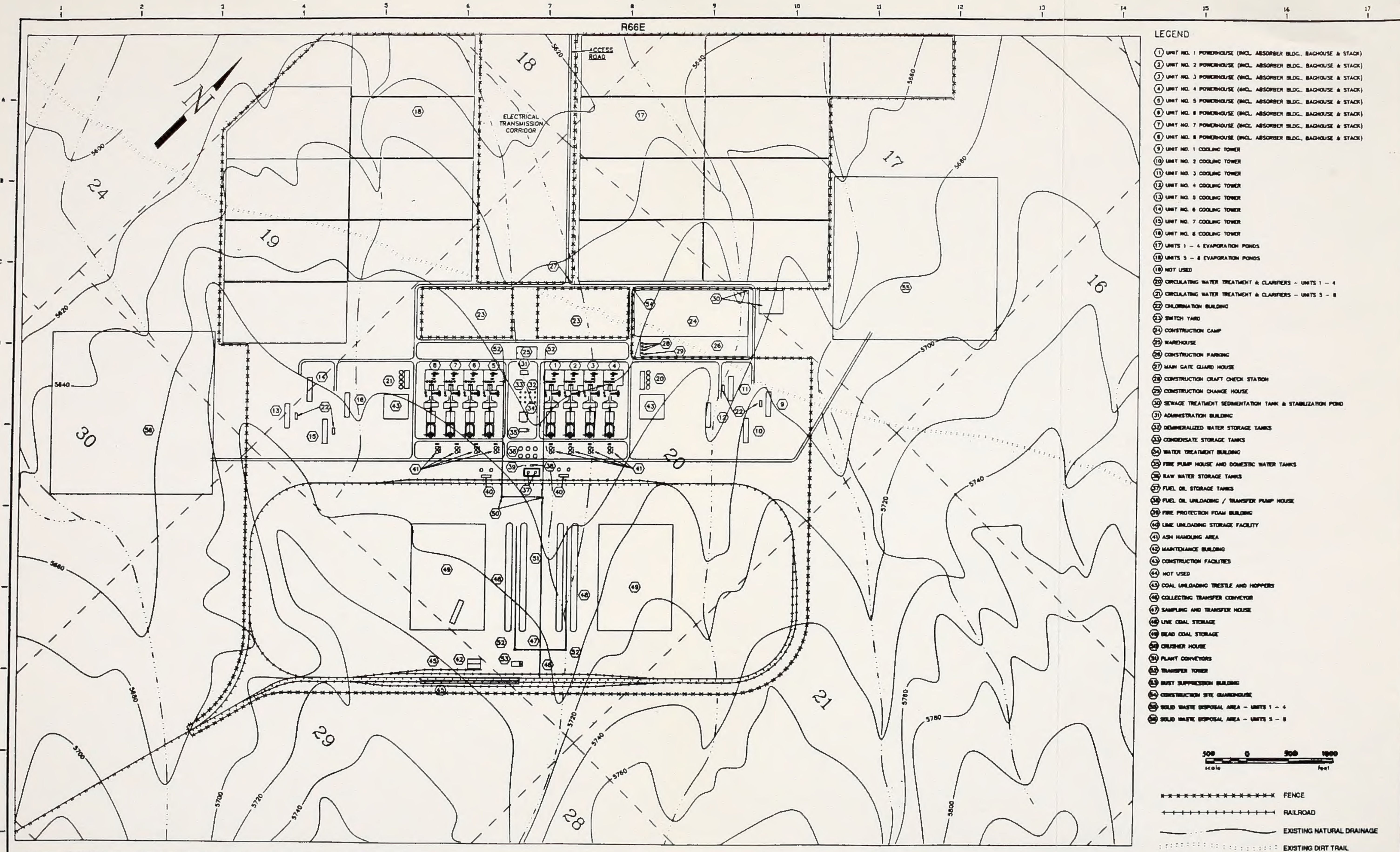


Figure 3.1-2. LOCATION OF PROPOSED POWER PLANT AND ANCILLARY FEATURES



Source: United Engineer and Constructors,
Stearns-Rogers Division, 1989

Figure 3.1-3. FACILITY PLOT PLAN

The stack would be provided with sampling platforms to accommodate manual and automatic sampling equipment. The location and size of the platforms would conform to appropriate standards of the Environmental Protection Agency and the Occupational Safety and Health Administration. Stack aircraft-warning strobe lights would be included in compliance with applicable Federal Aviation Administration regulations.

3.1.2.5 Plant Water Supply

The water source for the plant would be groundwater from the project's proposed wellfields. Most of the water from the wellfields would be used for makeup in the circulating water system; some would be treated and used for boiler makeup, plant potable water needs, and other purposes requiring treated, cool water (e.g., ash pump seals). The estimated maximum annual water demand would be 32,000 ac-ft/yr (4000 ac-ft/unit).

The water supply system would consist of water wells, buried pipelines, pumping stations, aboveground storage tanks, and metering and control systems. All pipelines would be buried a minimum of 3 feet to protect against freezing and other hazards. Pipelines would follow existing roads and rights-of-way, wherever feasible.

The proposed action for developing the wellfields (Figure 3.1-2) is summarized as follows:

- For power generating Units 1 & 2 - A wellfield would be developed within Toano Draw in an area about 1 to 5 miles south of the power plant site.

- For power generating Units 3 through 7 - A wellfield would be developed in the valley of Thousand Springs Creek, downstream from its confluence with Crittenden Creek. A buried pipeline approximately 33 inches in diameter would be required to convey the water from this wellfield to the power plant site.

- For power generating Unit 8 - The wellfield developed to supply Units 1 and 2 would be expanded.

Also, as part of the proposed action, irrigation uses of water by Lands of Sierra, Inc. in the area would be progressively curtailed to zero. Wells and wellfields would be designed and operated with the objective that they would cause no significant environmental impacts. Monitoring would be performed to determine project-induced impacts. If impacts were identified, mitigation measures would be implemented.

Water would be stored in aboveground, heated (to prevent freezing) steel tanks which also would be used for the proposed plant's fire protection and makeup water. Pumps would be provided to move the water from the storage tanks to plant service.

3.1.2.6 Cooling Water System
The cooling water system for each generating unit would include a condenser and a cooling tower, through which the waste heat (i.e., nonrecoverable energy in the spent steam) from the turbine steam cycle would be released to the atmosphere. The condenser and cooling tower would be connected by a circulating water system to form a closed-loop cooling system. The low-pressure element of each turbine would exhaust spent steam directly into a condenser. The resulting liquid condensate would be collected in the condenser hotwell.

Each cooling tower would be a multi-cell, mechanical-draft system. Reinforced concrete would be used for the cooling tower basin, which would act as a foundation support and a water catch basin for the tower. At design full-load conditions, the temperature of the circulating water entering the cooling tower would be about 20.4°F above the wet-bulb temperature. The design wet-bulb temperature of 59°F would be equaled or exceeded not more than 1 percent of the time on an annual basis. The water temperature change within the cooling tower (i.e., the differential temperature between water entering and leaving the tower) would be about 24°F.

3.1.2.7 Waste Management and Disposal Facilities
Surface Drainage. Surface runoff water from off-site, upgradient areas would be diverted around all station facilities and returned to the natural drainage channels north and west of the plant site. Surface runoff from the power plant site itself would be directed to the natural drainage channels, except those runoff waters which could be contaminated. Potentially contaminated runoff would be directed to and disposed of in the wastewater evaporation ponds on site (Figure 3.1-3). Runoff from the coal storage area would be directed to the evaporation ponds.

Floor Drains. Floor drainage from the plant could contain small amounts of materials such as oil, coal, chemicals, and dust. This water would be collected and drained by gravity, first to an oil/water separator and then to the evaporation ponds.

Sanitary Sewers. A compacted earth-lined sanitary sewage aerobic oxidation lagoon would be constructed concurrently with the construction worker camp. The lagoon would be completed and would be operational before the camp was occupied. It would have a service life that would end when the first zero-discharge evaporation pond (for disposal of plant-generated wastewaters) was completed and put in service. At that time, all sanitary sewage would be discharged to the evaporation pond, and throughout the operation of the power plant sanitary wastes would be discharged to one or more currently active evaporation ponds. Following the changeover to using the first evaporation pond, residual waste liquid in the oxidation lagoon would be left undisturbed, for natural evaporative disposal. Thereafter, solid waste remaining in the lagoon would be permitted to dry, by natural evaporation processes, and then be transported for disposal in the ash disposal landfill.

Evaporative Waste Ponds. Evaporative waste ponds, approximately 10 feet in depth, would be provided for storage and disposal of liquid wastes for the life of the plant. For Unit 1, a pond of approximately 30 acres would be constructed. Each newly constructed generating unit would have an additional 20-acre pond. The ponds would receive all nonreusable liquid wastes, such as coal pile runoff, cooling tower blowdown, ash system blowdown, sanitary waste, and wastewaters from chemical cleaning, intermittent boiler cleaning, and equipment washdown. The major chemical constituent in these ponds would be sodium sulfate. Consideration of seasonal variations in the evaporation rate would be included in the final determination of the pond size.

The preliminary design concept for the evaporation ponds includes a double-liner system utilizing a leak-detection system and inspection wells. Earthen berms would be constructed around the perimeter of each pond. Berm slopes would be three horizontal to one vertical or flatter. A sand bedding, approximately 6 to 12 inches thick, would be placed over the prepared pond foundation to provide a smooth surface for placement of the secondary membrane liner. The secondary liner would be high-density polyethylene of appropriate thickness, carefully placed and joined, above the sand bedding. After placement it would be tested to ensure the integrity of the liner. Where the liner was penetrated by the leak detection collector pipe, it would be sealed with a boot of the same material bonded to both liner and pipe. A network of perforated high-density polyethylene pipes would be placed over the secondary liner to collect any liquid that could penetrate the primary liner. A sand layer would then be placed over the secondary liner on the bottom of the pond. A drainage geonet (fabric filter) would be placed on the berm sideslopes, above the secondary liner, to direct leakage to the bottom of the pond. The fabric filter would serve the same function as the sand drainage on the bottom of the pond, and would be used to eliminate the difficulty of placing and holding sand on the sideslopes. The primary liner would be a high-density polyethylene membrane liner of appropriate thickness, placed above the drainage layer. The primary liner would not be covered, as it would be stable when exposed to the elements.

Any leakage that may penetrate to the drainage layer would be collected and piped under the pond containment berm to an inspection well, located beside the pond, where the leachate would be collected, measured, and tested. The number and location of inspection wells and monitoring procedures would be determined by the Nevada State Engineer.

An 8-foot-high chain-link fence would be installed around the evaporation ponds to prevent entry by unauthorized personnel. Cautionary signs would be attached to the fence to warn all persons of the contents of the pond.

3.1.2.8 Solid Waste Disposal

Nonputrescible solid wastes generated during plant construction and operation would be disposed of in a landfill within proximity to the plant, according to state requirements. As the fill progressed, the compacted waste would be covered with soil material and revegetated. After the plant construction is completed, the only materials to be landfilled (other than mill rejects, ash, and sulfur dioxide scrubber waste), would be small amounts of debris generated by plant remodeling and maintenance activities.

3.1.2.9 Fuel Receiving, Storage, and Handling System

The coal handling system at the station would include facilities for receiving and unloading of unit trains, and covered facilities for conveying, storing, reclaiming, blending, and conveying the coal to the steam generating units. Plant equipment would include coal crushers and pulverizers.

3.1.2.10 Plant Control Systems

Combustion Control System. The plant combustion control system would be a state-of-the-art, microprocessor-based, Distributed Control System. This system would be designed to ensure personnel safety, equipment safety, and electrical generation. The system would have several processors, which would operate independently of each other but would maintain communications over an electrical or fiber-optic data highway. In the event that a data highway failed, a backup highway would be immediately available to prevent a loss of communications. In the unlikely event that both highways failed simultaneously, the independent controllers would continue to function to prevent loss of plant control. Systems would be designed to fail in a safe direction, generally interrupting the flow of energy.

Control Room. The plant operators would control the plant from central control rooms. One control room would be provided for each pair of generating units. Ultimately, there would be four control rooms for the eight units. The primary operator interface to the plant would be via control cathode ray tube monitors and keyboards. Several of these monitors would be provided for each unit to ensure the operators' ability to oversee various aspects of plant operation, and provide backup systems if needed. Additionally, printers would be provided in the control room to signal alarm/abnormal conditions and to provide utility functions to be designated by the operators.

Additional control room equipment would include hardwired backup controls for some critical plant functions. Typically, these would include a master fuel trip switch, to trip the boiler, and electrical/switchyard controls.

Burner Management System. The Burner Management System would use Distributed Control System hardware to implement boiler protection functions. This system would communicate with the Combustion Control System for reliable boiler operation. Flame scanners would be provided on all burners in the furnace to allow continuous verification of safe

operation. These scanners would provide verification that burner light-off had been achieved and would also monitor flame stability.

In the event that the Combustion Control System was unable to control the boiler in a safe manner, the Burner Management System would shut down the boiler to prevent an accident from occurring. Typical trip conditions would be excessively high or low furnace pressure and flame collapse in the furnace.

The Burner Management System would use redundant power supplies, microprocessors, and communications for continuous, reliable operation. A hardwired backup relay (powered by station batteries) would allow the control room operator to trip fuel to the boiler even in the event of loss of alternating current power. Burner Management System control logic would be implemented in very secure Programmable Read Only Memory chips to prevent an inadvertent change to logic by plant personnel during routine maintenance. Alternatively, the Burner Management System control logic could be coded to be accessible to maintenance personnel only with the use of a password to prevent unauthorized changes.

Wells and Wellfields. Pumps on the power plant water supply wells would be monitored and controlled from the power plant control rooms. The monitoring would be provided by lights on the control panel indicating if a pump was on or off. Control switches on the operator's console would permit remote starting and stopping of the pumps. Communication between the power plant and the wells would be by radio signals and/or communications cable. Radio communication would employ an antenna at the pump house for each individual well. Communication cables would be installed either in the same trench as the pipeline connecting the well to the power plant or suspended on the power poles that provide electrical service to the well pumps.

3.1.2.11 Fire Protection Systems

Water for fire protection systems would be supplied from both electric motor-driven fire pumps and diesel engine-driven fire pumps. These fire pumps would be located in the the fire pumphouse near two 600,000-gallon fire/raw water storage tanks. The pumps would draw water from either or both tanks. A hydropneumatic tank and 50-gallon-per-minute (gpm) maintenance pump, with associated controls, would be provided to maintain continuous pressure in the fire protection system headers so a fire pump would not be required to operate except when system demand exceeded the capacity of the maintenance pump. Automatic operation of the pump would maintain a normal water pressure between 100 and 110 pounds per square inch gauge.

3.1.2.12 Emergency Power

A battery type, direct-current system would be provided for emergency power. The 125 volt normal direct-current system would furnish power for controls, backup motors, emergency lights, and an inverter for vital alternating-current loads.

A diesel generator would be provided to furnish electric power for critical loads during emergency conditions. The diesel would be self-contained with its own starting battery to operate the fuel oil pumps and closed cooling system. An uninterruptible power supply would be provided to furnish reliable and regulated 120 volt alternating-current, single phase, 60 hertz power for critical loads, including the plant computer and other vital control equipment.

Plant backup transformers, capable of providing power to the plant during outages, would also be provided. These transformers would be connected to the local utilities' electric power system, and would provide the normal power to the 120 volt alternating-current uninterruptible power supply.

3.1.2.13 Construction-Worker Accommodations

On-site housing would be provided for the construction workers. Quarters would be provided for approximately 220 construction personnel. The quarters would be composed of portable or fixed buildings and could house two workers to a room with a bathroom. There would be a staffed kitchen, mess hall, laundry room, and recreation hall.

In addition, a recreational-vehicle park would be constructed to accommodate approximately 300 vehicles. This park would consist of parking spaces, electrical, water, and sewer hook-ups, shower/toilet facilities, and a laundry building. The worker housing and the recreational-vehicle park combined would accommodate 520 construction workers (or more if two or more workers shared a recreational vehicle).

3.1.2.14 Access Road

The proposed plant access road would run from U.S. Highway 93 near Wilkins, east for approximately 4 miles along an existing county road, and then southeast to the project site. The county road would be upgraded, and approximately 10 miles of new road would be constructed from the county road southeast to the plant site at a maximum width of 100 feet. A stream-crossing culvert would be used to cross the main channel of Thousand Springs Creek. An earthen embankment would carry the road across the remainder of the floodplain. Smaller pipe culverts would be used, as required, for crossing other minor drainage channels. Bituminous (i.e., asphalt) paving would be used for the wearing surface of the two-lane road from Wilkins to the plant site. The access road to the plant would be fenced with a BLM-specified fence to prevent domestic livestock from encroaching on the road but allow wildlife to cross. The road around the main plant area would be paved in the vicinity of the first unit, and would be extended as additional units were built. All other roads would have a gravel-wearing surface. A paved parking area would be provided near the administration offices. Gravel maintenance roads would be used to service the evaporative wastewater pond and cooling towers. Gravel, for use in construction and maintenance of the roads, would be purchased from existing gravel suppliers. No additional public lands would be involved in obtaining gravel.

3.1.2.15 Railroad

The Southern Pacific Railroad (SP) has a two-track line from east of the plant site that passes through Montello and Cobre to Wells. A railroad spur, to transport coal to the facility from coal mines in Kemmerer, Wyoming, and Scofield, Utah, would be constructed off of the Southern Pacific Railroad track. It would begin approximately 3 miles northwest of Cobre, at Valley Pass, and would run northwest approximately 14 miles to the plant site with a maximum width of 200 feet. The railroad spur would be constructed with two short tracks from Southern Pacific Railroad's dual track, to allow ingress to and egress from the plant site. The spur, unloading loop, and switchyard would be designed and constructed in conformance with railroad standards. The railroad spur to the plant site would be wire-fenced, using BLM specifications. The unloading loop would be designed so that two unit trains could unload coal simultaneously (one 55-car unit train would carry approximately 6600 tons of coal), although initial construction would provide for unloading only one train at a time. The loop would be expanded to serve two trains in conjunction with construction of the fifth. Proposed railroad coal delivery routes from the two coal mines are illustrated on Figure 3.1-4.

3.1.3 CONSTRUCTION OF THE POWER PLANT

3.1.3.1 Construction Activities

The proposed power plant, upon completion of development, would consist of eight 250-MW, coal-fired, steam-electric generating units. Construction of the first unit is described here in terms of the following seven overlapping phases:

1. Access road construction and site preparation
2. Construction of internal access and utility network
3. Construction of plant facilities (housing, shops, fire pumphouse, etc.)
4. Concrete foundation installation
5. Structural steel erection
6. Major equipment and main building erection
7. Piping, electrical connection, and instrumentation installation

Based on market demand, the applicant has projected that construction of the first unit would commence in early 1991 and be completed in late 1994. Commercial operation of this unit would likely begin in late 1994.

Phase 1 activities would involve clearing, grading, and surfacing approximately 14 miles of heavy-load type asphalt access road, clearing and grading of approximately 14.5 miles of railroad bed, and site preparation for construction facilities. The access road would require a 100-foot-wide construction route, and the railroad spur would require a 200-foot-wide construction route to accommodate the equipment during construction and for the storage of materials. A disturbance of approximately 380 acres would occur during construction.

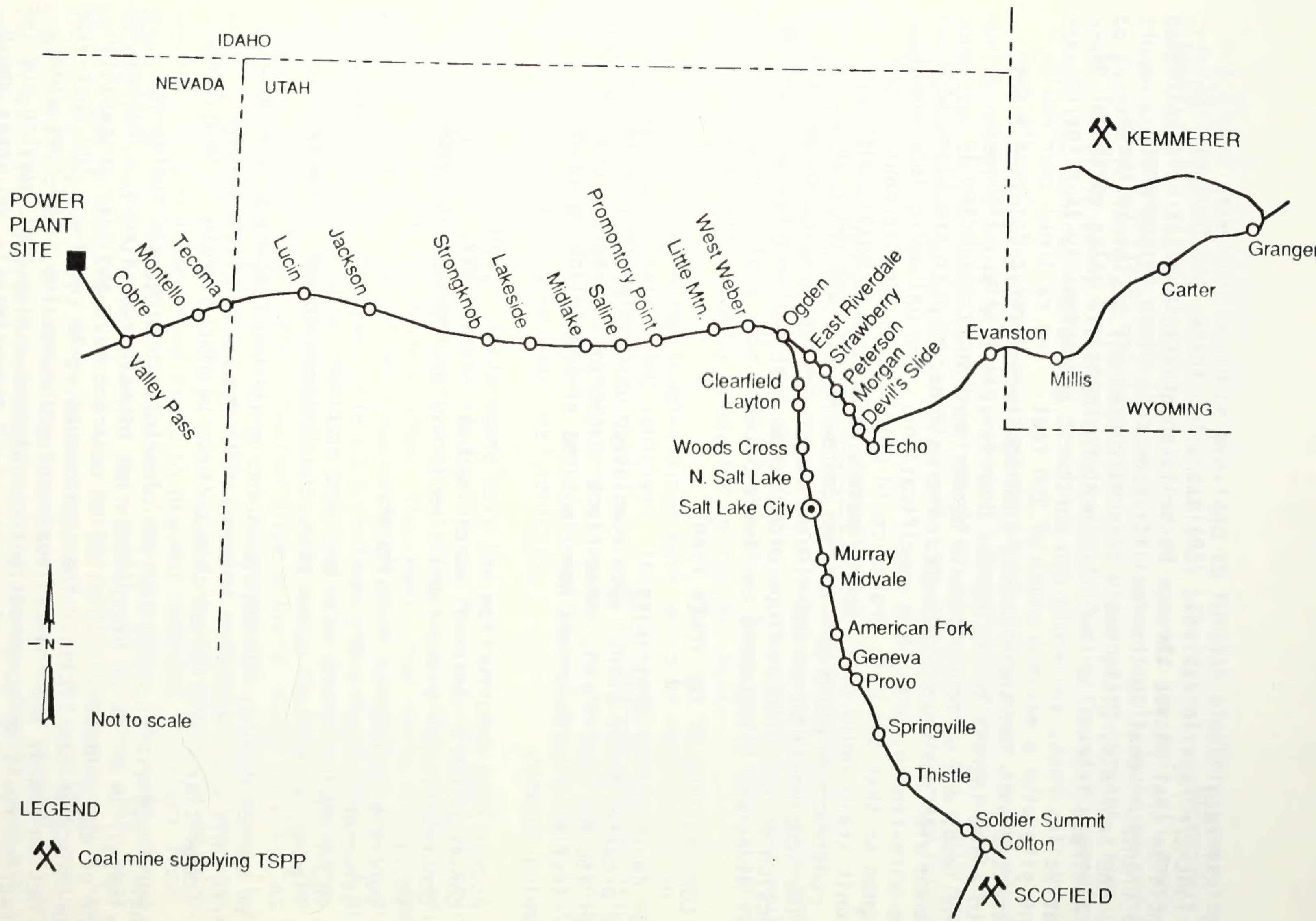


Figure 3.1-4. PROPOSED RAILROAD COAL DELIVERY ROUTES

Phase 2 would involve excavation, installation, and backfilling of underground facilities for water lines, sewers, drains, and electric ducts. Roads serving construction offices, warehouses, storage areas, fire pump house, etc., would be developed at this time.

Phase 3 would start the building of both temporary and permanent plant facilities. Temporary facilities include construction-worker housing, the RV park, the construction management personnel and contractors' office area, warehouses, a materials storage area, and unprotected material storage sites. Permanent facilities to be constructed during Phase 3 would include a fire pumphouse, wells, a potable water treatment building, power lines, an electric substation, and a telephone system.

The majority of the concrete work would begin during Phase 4. Pits would be excavated for spread footings and concrete would be poured into forms. Trenches would be dug for the grade beams and the concrete would be poured. Slabs would be poured into forms, with reinforcing steel, on compacted ground surfaces.

Phase 5 would involve erecting the main steel framing that would support the boiler and all major equipment. It would also involve constructing the rail spur, coal receiving, and unloading siding.

In Phase 6, large-diameter pipes would be hoisted into their approximate locations for later installation and electric cable support trays would be erected. Boiler and turbine generator erection would then begin.

Phase 7 would involve connecting the various ducts, pipes, communications conduits, conveyors, and other equipment required to operate and control the fuel, air, steam, water, waste product, and electric systems. Piping would be routed to the respective areas using welding or mechanical bolting. Electric cables for operating motors, lights, switches, and controls would be connected throughout the plant. Instruments needed to control and monitor all the processes would be installed and connected to display panels and recorders in the control room.

Dependent upon market demand, construction of additional generating units would require approximately 34 months each and would overlap with the preceding unit by 10 months. This would allow for an efficient transition of resources from unit to unit. As site preparation, excavating, backfilling, and concrete activities would be completed on one unit, they would start on the next. Some of the other activities such as structural steel, electrical, and pipe erection would involve short breaks between units due to their shorter construction durations. However, a portion of all the crafts involved would be needed almost continuously throughout the entire project construction period for final touchup and warranty work.

The timing for implementation of each phased unit would be dictated by market demand for electrical power. The first peak of construction

personnel is anticipated to be approximately 800 workers in 1993, associated with construction of Units 1 and 2. The average workforce during that year is anticipated to be approximately 500. A second workforce peak is anticipated between the completion of the fourth and fifth units in 2000 due to the addition of duplicate major facilities such as:

- Coal unloading, handling, and storage facilities
- Fire protection, pump house, tanks, and water mains
- Plant electrical substation and associated equipment

Further descriptions of anticipated workforce numbers are provided in Appendix B.

Site clearing, grading, and surfacing would be confined to those areas which are to be built upon or utilized during construction, or which are part of the ash disposal area. Site clearing would be conducted on an "as-required basis," and individual areas would be cleared just prior to construction startup. Vegetation that required removal would be disposed of on site in a Class III disposal site.

Grading requirements for the site are minimal, owing to the relatively flat existing terrain. The immediate powerhouse area would be graded to a uniform level and sloped away from the plant in all directions. The coal storage area would be graded to a uniform level and sloped towards the evaporation ponds to provide drainage and control of runoff containing fine coal particles. Other disturbed areas would be graded to preserve natural drainage patterns and to prevent erosion. In total, approximately 1240 acres of land would be disturbed at the power plant site upon completion of development. Including the railroad spur, access road, and water pipeline, a total of approximately 1780 acres would be disturbed upon completion of development. Table 3.1-3 summarizes the acres disturbed or covered by project components on a unit-by-unit basis.

3.1.4 OPERATION OF THE POWER PLANT

The proposed action for the power plant operation involves a baseload power plant, operating 24 hours a day, 365 days per year. The plant would operate using three 8-hour workshifts. The operational workforce would be approximately 145 persons for each pair of units or 564 operation workers upon completion of all eight units.

3.1.4.1 Fuel Receiving, Storage, and Handling

The power plant would burn low-sulfur coal. Coal would be delivered to the plant site by unit trains. The coal would be produced from mines at Kemmerer, Wyoming, and Scofield, Utah. Each mine would supply coal in an amount equal to 50 percent of the heat input to the generating units.

According to the applicant, studies conducted by the John T. Boyd Company determined that these two mines can supply the required coal

Table 3.1-3. APPROXIMATE AREAS OF DISTURBANCE BY CONSTRUCTION ACTIVITIES PER 250-MW UNIT (ACRES)

POWER GENERATION UNITS:	1	2	3	4	5	6	7	8	Total
PLANT SITE									
Units 1-8 and Main Plant	20	15	15	15	15	15	15	15	125
Railroad Loop	60								60
Construction-Worker Camp	18								18
Switchyard	4	4	4	4	4	4	4	4	32
On-site Roads	14	3	3	3	3	3	3	3	35
Cooling Towers	7	6	6	6	7	6	6	6	50
Major Drainage Structure	5								5
Solid Waste Disposal	67	67	67	67	67	67	67	67	536
Sewage Lagoon	5								5
Evaporation Ponds	30	20	20	20	20	20	20	20	170
Construction Laydown Area	30	10	10	10	10	10	10	10	100
Coal Runoff Pond	12				12				24
Coal Piles (dead storage)	10	10	10	10	10	10	10	10	80
Subtotal									1240
ANCILLARY FACILITIES									
Proposed Access Road (100' width)[a]	120								120
Railroad (200' width)[a]	260								260
Water Pipeline (50' width)[a]	5		155						160
Subtotal									540
TOTAL	667	135	290	135	148	135	135	135	1780

[a] Actual area disturbed during construction would be less. The area permanently covered by ancillary facilities would be less than that disturbed during construction.

Source: Thousand Springs Generating Company

without increasing the size of the mines or the scale of the mining activities that are in their respective approved mining plans and their business plans.

Coal would be delivered along a new rail spur, approximately 14 miles long, between the Southern Pacific Transportation Company's main line at Valley Pass and the plant site. The new spur would be constructed and maintained by TSGC.

All eight generating units would be served by two coal receiving, storage, and handling systems. Each system would independently serve four generating units, and would be designed using identical equipment. Coal would be received from the mine(s) in unit trains that would operate continuously between the mines and the plant.

At full load conditions, using coals complying with the performance specifications, and operating at a capacity factor of 100 percent, each generating unit would consume approximately 1380 tons/day of coal from the Scofield mine and approximately 1620 tons/day of coal from the Kemmerer mine, for a total of approximately 3000 tons/day/unit. The demand would be somewhat lower based upon the average annual load factor (i.e., 85 percent) of each unit. Average total annual coal consumption thus would be approximately 926,700 tons/unit. To support this average firing rate, each unit would require one 55-car unit train to be delivered every 5 days from the Scofield mine, and every 4 days from the Kemmerer mine. Four to five 55-car unit trains would deliver coal per day to the plant site with eight units operating.

Units 1 and 2. Coal from the unit train would be dumped into a compartmentalized undertrack bunker below the unloading trestle while the train is in motion (up to 5 mph). Unloading would require about 20 minutes for a 55-car unit train. The bunker would have the capacity to hold up to 100 cars (104 tons each) of coal from each of the two mines. Two rotary plow feeders (located below the unloading trestle) would transfer the coal from the bunker to one 3200-tons/hr trestle reclaim conveyor. The reclaim rate would be variable, from 0 up to 1600 tons/hr of each coal. For the first two units, the reclaim rate would be 900 tons/hr total. The rotary plows would allow blending the coal at this point, if a bunker of each coal is available. A magnetic separator would be mounted at the discharge end of the conveyor to remove ferrous material from the coal.

Once the coal had been blended and transferred, the trestle reclaim conveyor would discharge to the unloading transfer conveyor, which would discharge to either the yard conveyor or the dead storage transfer conveyor. The yard conveyor would, in the future, discharge to either a silo feed conveyor or a crusher transfer conveyor. For Unit 1, however, the silos would not be in place, and all coal would be discharged to the crusher transfer conveyor and be taken directly to the crusher facility.

Units 3 and 4. When the third unit was constructed, a redundant conveyor system would be added. In addition, live storage silos and the required storage silo feed, reclaim conveyors and equipment would be added. An additional 55- to 85-car unit train would also need to be added for the third and fourth units. The addition of live coal storage silos would eliminate the need to maintain active live coal storage piles. Coal could still be reclaimed from the dead storage piles if needed.

One or two live storage coal silos would be provided for coal from each of the two mines. Each silo would be approximately 70 feet in diameter by 210 feet high, with a capacity of approximately 12,000 tons. This is equivalent to 4 days of live storage for one unit in each storage silo. Additional storage silos may be added for more live storage.

All Eight Units. Inactive (dead) coal yard storage would be provided for the station based on 45 days' supply for eight units at an average annual load of 85 percent of nominal generation capacity. The dead storage area would provide a reserve from which the station can be supplied during coal shortages or emergency situation, (e.g., mine strikes, rail strikes). Coal would be segregated in the yard by mine source. A conveyor would be provided for yard stackout of the delivered coal. From the stackout point, coal would be either dozed or hauled by self-loading scrapers to its desired storage area. Based upon a coal pile height of 30 feet, areas of approximately 13 acres and 15 acres will be allotted for dead storage of the Scofield and Kemmerer coals, respectively. This would provide a 45-day supply for eight units.

Dust control would be provided at all of the transfer points in the conveying system. The coal handling system would utilize five forms of dust control: suppression, collection, ventilation, containment, and washdown. Throughout the system these methods would be employed to minimize fugitive dust generated by the handling and processing of the coal.

Dust Suppression. The dust suppression supply pump, tank, and controls would be located in the Sampling and Transfer House. Blowdown from the circulating water system would be used as the water source.

Dust Collection (Dry). Several bag-type dust collectors would be incorporated into the coal handling systems, one at the Sample and Transfer House, one at the Crushing Building, one at the Transfer Tower, and one at each Unit Coal Silo Area. The dust collectors would be fully automatic and interlocked with the coal handling system.

Ventilation. Ventilation systems would be located at numerous points throughout the coal handling system. At the Dump Hopper Collection Tunnel, the system would supply ventilation for the unloading area. Tunnel ventilation systems would also be located at each dead Storage Reclaim Tunnel. Ventilation would also be provided to the tripper area of each Unit Coal Silo Area.

Containment. Dust migration to the atmosphere would be minimized by containment in various ways. The conveyor galleries would be totally enclosed. All coal transfer equipment, belt feeders, vibrating feeders, and diversion gates would be totally enclosed to reduce coal dust emissions.

Washdown. All walkways, platforms, and other places with horizontal surfaces where fugitive dust might accumulate would be washed down periodically.

3.1.4.2 Power Generating System

Each generating unit (system) would include a boiler, turbine generator, lime spray dry scrubber, fabric filter, stack, and mechanical draft cooling tower. For all practical purposes, each unit would include essentially identical components to facilitate equipment interchange.

The estimated normal average load factor for a unit would be 85.8 percent for the first 5 years of operation. The load factor would progressively decrease to an estimated 53.2 percent in the 31st year of operation and thereafter (refer to Table 3.1-4). The average load factor for each unit over its expected 35 years of operation would be approximately 75 percent.

Boilers. The boilers would be designed to operate with coals having properties essentially as listed in Table 3.1-5. Coal, conveyed from the coal yard area, would be distributed to and stored in four steel boiler, silos included with each boiler. The boiler silos would have 12 hours total storage capacity. Coal, discharged from each boiler silo, would flow by gravity to a gravimetric-type coal feeder through a cone having a shutoff gate. Each of the feeders would discharge through a pipe to a pressurized coal pulverizer (four per unit). The coal would be pulverized to 70 percent minus 200 mesh sieve size (or 0.074 mm). A large percentage of the iron pyrites present in the coal would be segregated from the coal during grinding and discharged through a reject side stream to the bottom ash handling system.

Two primary air fans per generating unit would supply air for pneumatically conveying coal from the coal pulverizers to the coal burners (fuel nozzles) mounted on the walls of the furnace. Coal would be supplied to several fuel nozzles from each of the four coal pulverizers serving a boiler. The coal conveyance air would constitute a major part of the air required for the combustion process. Secondary air fans would supply the balance of the required combustion air.

The entire combustion process would be designed to ensure that coal combustion would be complete. Excluding flue gas, the principal products of burned coal would be bottom ash, fly ash deposited in the economizer and air preheater hoppers, and fly ash carried through to the scrubber and baghouse.

Table 3.1-4. SUMMARY OF UNIT ANNUAL LOAD FACTORS BASED ON VENDOR GUARANTEES

Years	Avg. Load
1-5	85.8
6-10	84.9
11-15	83.4
16-20	79.9
21-25	73.6
26-30	64.5
31-35	53.2

Levelized Annual Operating Factor 75 percent (based on maximum capacity generation)
Operation factors over plant life expressed as percentages of 8760 hours

Source: Thousand Springs Generating Company

Table 3.1-5. BASIS OF DESIGN COAL AND ASH ANALYSES

	Pittsburg & Midway Kemmerer Mine		Coastal States Skyline Mine	
	Average	Range	Average	Range
Proximate Analysis				
% Moisture	21.0	19.0-23.0	10.0	8.0-13.0
% Ash	5.5	3.5-7.0	9.5	7.5-13.5
% Volatile	33.6	31.5-35.5	39.0	37.0-42.0
% Fixed Carbon	40.3	38.1-42.2	41.5	39.0-44.0
Btu/lb	9800	9600-10,000	11,500	10,900-11,900
% Sulfur	0.8	0.6-1.0	0.65	0.45-0.8
Ultimate Analysis				
% Moisture	21.0	19.0-23.0	10.0	8.0-13.0
% Carbon	56.5	54.2-60.6	63.8	59.4-67.1
% Hydrogen	3.90	3.7-4.2	4.73	4.5-5.4
% Nitrogen	0.80	0.7-0.9	1.44	10.0-1.58
% Chlorine	0.01	0.0-0.0	0.02	0.0-0.05
% Sulfur	0.80	0.6-1.0	0.65	0.5-0.8
% Ash	5.5	3.5-7.0	9.50	7.5-13.5
% Oxygen	12.09	11.0-12.5	9.84	9.0-11.7
Hardgrove Grindability	60		48	43-50
% Equilibrium Moisture	19.2		NA	
Alkalies as Na_2O (dry coal)	0.1		NA	
Free Swelling Index	Nil		NA	
Ash Fusion Temperature (°F)				
	Reducing	Oxidizing	Reducing	Oxidizing
Initial Deformation	2250	2300	2100	2150
Softening (H=W)	2360	2380	2200	2250
Hemishperical (H=1/2W)	2375	2450	2250	2300
Fluid	2500	2575	2300	2350

Table 3.1-5. BASIS OF DESIGN COAL AND ASH ANALYSES (concluded)

	Pittsburg & Midway Kemmerer Mine		Coastal States Skyline Mine	
Mineral Analysis of Ash (% in ash)				
	Average	Range	Average	Range
Silica, SiO_2	46.9	42.0-52.0	57.0	50.0-61.5
Alumina, Al_2O_3	21.4	18.0-25.0	14.5	11.5-16.5
Titania, TiO_2	0.8	0.6-1.0	0.7	0.5-0.85
Ferric Oxide, Fe_2O_3	5.1	3.0-8.0	6.4	5.4-7.4
Lime, CaO	10.7	8.0-14.0	10.2	5.0-16.0
Magnesia, MgO	3.2	1.5-4.0	2.1	1.0-3.0
Potassium Oxide, K_2O	0.5	0.4-0.6	0.9	0.6-1.1
Sodium Oxide Na_2O	0.3	0.2-0.4	1.8	1.1-2.8
Sulfur Trioxide, SO_3	10.4	8.0-13.0	6.0	4.0-8.0
Phos. Pentoxide, P_2O	0.3	0.2-0.4	0.5	0.2-0.7
Lithium Oxide, Li_2O	0.0	0.0-0.0	--	---
Manganese Oxide, MnO	0.1	0.0-0.1	--	---
Undetermined	0.3	---	--	---

Source: Coastal States Energy Company and Pittsburg & Midway Coal Company

Oil-fired ignitors would be provided at each burner for initial lighting of the burners and warmup of the furnace. Fuel for the ignitors would be No. 2 fuel oil, supplied by pumps from an on-site oil storage tank. The fuel oil tank would be placed within an earth-diked enclosure capable of retaining at least 110 percent of the maximum stored volume of oil.

Air Emission Control System. Lime, purchased off site and delivered to the plant, would be conveyed to long-term (15-day) storage silos located adjacent to the unloading area. Pneumatic conveyors would transfer lime from the long-term storage silos to the scrubber day bins. Lime from a commercial source would be required at a rate of about 50 tons per day for each unit at full load. No additional public lands would be disturbed for obtaining lime.

Initially, lime would be delivered to the plant by 25- to 30-ton capacity, differential pressure, pneumatic transfer trailers. Provisions would be made to allow rail delivery of lime, as the demand for lime increased with the size of the station, (i.e., as additional units were placed on line).

Flue gas exiting the boiler air preheater, at approximately 280°F, would enter the top of the spray dryers. At the top of each spray dryer, the flue gas would be distributed through scrolled dispersers. At the discharge of the dispersers, the flue gas would interface with a finely atomized spray of scrubber slurry. Atomization of the slurry would be accomplished by high speed spray machines, which include centrifugal atomizer discs.

The gas exiting the dispersers would travel down the spray dryer chamber. As a result of the thorough mixing of the flue gas and the lime slurry spray, sulfur dioxide gas in the flue gas would react with calcium hydroxide in the slurry to form calcium sulfite and calcium sulfate. Simultaneously, the sensible heat of the gas would cause the water in the slurry mist to evaporate, leaving a dry particulate residue suspended in the treated gas stream. The gas stream would exit through the angled bottom of the spray dryer vessel at approximately 165°F. The scrubber reaction products and fly ash would be transported by the gas stream to the baghouse for particulates collection.

At the baghouse, fly ash/scrubber byproduct-laden gas would be drawn into the baghouse inlet manifold duct. Particulate matter from the gas stream would be deposited on the interior of the filter bags. Cleaned gas, exiting the filter bags of each compartment, would be drawn into an outlet manifold, and would be drawn into the outlet duct by the induced draft fans and discharged to the atmosphere through the stack.

Particulates collected on the interior of the filter bags would be periodically dislodged from the bags by the reverse gas cleaning process. The particulates would fall into the compartment hopper. Material collected in the hopper would be pneumatically conveyed, by the fly ash

handling system to the fly ash storage silo. There it would be mixed with bottom ash, and then trucked to disposal in an on-site landfill.

The bottom ash (i.e., the coarse ash collected at the bottom of the furnace) and mill rejects (pyrites) would be sluiced from the plant and dewatered before being mixed with fly ash and trucked to the landfill. Based on the estimated use of coals, at full load each unit would produce about 1.4 tons/hr of bottom ash and pyrites. Over the expected life of the plant, about 2.6 million tons of this material would be produced in total.

Fly ash and scrubber byproduct would be collected in the baghouses. Fly ash would also fall out in the economizer and air preheater hoppers. This waste would be transported pneumatically to the fly ash silo. At full load each unit, burning the designed coals, would produce about 11 tons/hr of fly ash and scrubber byproduct. Over the expected life of the plant, approximately 20.5 million tons of fly ash and scrubber byproduct would require disposal. The fly ash/scrubber byproduct would be wetted, by mixing with the wet bottom ash, to approximately 15 percent moisture by weight before being trucked to the landfill (to aid in handling, preventing dusting, and improving compaction characteristics). The total landfill disposal acreage required for both bottom ash and fly ash/scrubber waste is estimated to be approximately 535 acres, assuming an average disposal depth of about 20 feet. Surface runoff waters, from areas upgradient of the ash disposal area, would be diverted around and past the disposal area, to protect the integrity of the disposal facility. Final design of the disposal facility would be based on the results of a detailed geotechnical investigation of the disposal area, to be accomplished as part of the design process, and regulatory requirements for the disposal of the materials as would be applicable at the time of design for each generating unit. It is expected that, as a minimum, the disposed material would be capped with a relatively impervious, compacted earth material that would be graded and sloped to facilitate surface runoff but without significant potential for erosion and removal by either wind or water.

The applicant has indicated that if, for any reason, the air emissions control system fails to perform (i.e., upset condition), then the operation of that electric generation unit would be curtailed, as necessary, until such time as the air emissions control system functions normally.

<u>Turbine-Generator</u>. The turbine-generator of each unit would have a nominal gross (nameplate guarantee) rating of 267,521 kW, which would yield a net output of 250,000 kW. The maximum gross generating capability (maximum load) for each unit would be 292,666 kW with the control valves wide open, and steam at 5 percent overpressure (above the nominal design pressure).

The turbine generator would convert the energy in high-temperature, high-pressure steam (1000°F, 2400 pounds per square inch [psi]) to electrical energy. The electricity would be delivered to the unit main stepup transformer and on to the switchyard for regional distribution.

Steam to drive each turbine generator would be piped from its respective boiler. The low-pressure, low-temperature steam exhausted from the turbine would discharge directly into a condenser. The resulting condensate would be returned to the boiler. Condenser cooling water (circulating water) would be pumped to the top of a mechanical-draft cooling tower (one for each unit) where it would be exposed, in the form of falling droplets, to a counter flow of air which would cool it, primarily by evaporation. The cooled water would be recycled to the condenser. Makeup water would be supplied to the cooling tower from the well system, after proper treatment.

Condensate Feedwater System. Condensate would be pumped from the condenser hotwell and would be routed to the economizer inlet of the boiler. Feedwater heaters would be provided in this system to increase the temperature of the condensate before it enters the boiler. Steam, extracted from various sections of the turbine, would be piped to the various feedwater heaters.

Upon exiting the deaerator, the condensate, now referred to as feedwater, would be pumped through two high-pressure feedwater heaters and into the economizer of the boiler. A boiler feed pump would take suction from the deaerator.

Cooling Tower. The circulating water would be warmed in its passage through the condenser by heat released due to condensation of the low-temperature, low-pressure steam exhausted from the low-pressure turbine. The heated circulating water would be pumped to the cooling tower via underground circulating water piping. In the cooling tower, the circulating water would be cooled by exposing a large water surface area in the form of small, falling water droplets to a mechanically induced upward flow of air. The water would be cooled by both sensible heat transfer and by evaporation of some of the water. For each generating unit, two circulating water pumps would return the cooled circulating water through underground piping to the condenser. Some of the circulating water would be drawn off to serve other heat exchangers associated with the overall generating unit.

In the cooling tower, approximately 1 pound of water would be evaporated and discharged to the atmosphere for each pound of steam condensed in the condenser. The amount would vary slightly, depending upon the amount of sensible heat absorbed by the air from the water. Evaporation losses would be less in winter than in summer. Additional water losses from the cooling tower (drift) would result from mist entrained in the air stream discharging from the top of the tower. Drift eliminators would limit and control this loss. Generally, about 0.005 percent of the tower flow normally would be lost as drift.

To maintain acceptable levels of dissolved solids and to avoid scaling in the condenser, cooling tower (circulating) water would be drawn off continuously (blowdown) and replaced by freshwater. The blowdown water would be used as a source of water for the scrubber, coal dust suppression,

bottom ash transport, and other uses. Freshwater would be added to the circulating water system to compensate for losses due to evaporation, drift, and blowdown.

3.1.4.3 Water Treatment for Circulating Water System

Evaporative water losses in the cooling tower would concentrate the dissolved solids in the remaining water. As these concentrations increase, calcium carbonates and silica in the water could cause scaling on the condenser tubes and decrease the heat transfer efficiency of the condenser and thus decrease the efficiency of the plant. To prevent scaling, the pH level of the water would be adjusted automatically, as required, by the addition of dilute sulfuric acid.

To minimize plant water use, the dissolved minerals in the circulating water probably would be concentrated by a factor of 20 to 30. It is expected that either the makeup water would be treated by the lime soda process or a side stream from the system would be treated by lime softening, or both processes would be utilized to maintain hardness and silica levels below their scale-forming concentrations.

To prevent biological growth and slime buildup from adversely affecting the heat transfer efficiency of the condenser and fouling the cooling tower, circulating water would be treated with chlorine, as required. Chlorine for each unit would be stored in 1-ton cylinders in a separate building with alarms, vents, and containment structures.

3.1.4.4 Plant Water Supply

Water, for use in generating steam and for transferring plant-generated waste heat to the atmosphere, would be obtained from wellfields in the Thousand Springs drainage basin (Figure 3.1-2). The wellfield to supply three generating units would be located in Toano Draw Subbasin, where the power plant would be located. For the other five units, it is expected that one or more wellfields would be developed along the lower reaches of Thousand Springs Creek in the vicinity of Gamble Ranch. The estimated maximum plant water requirement is 4000 ac-ft/yr per generating unit, or 32,000 ac-ft/yr upon completion of plant development.

The conceptual design of the pipeline would be 33-inch-diameter metal pipe, buried to a depth of 3 feet, and would require a maximum width of 50 feet of disturbance and an approximate length of 26 miles.

Lands of Sierra, Inc. (LOS), a subsidiary of Sierra Pacific Resources, owns extensive lands and most of the water rights that have been granted in Thousand Springs Basin. LOS has contracted with TSGC to supply all water required to construct and operate the TSPP.

Well pumps would be operated with electric power supplied by Wells Rural Electric Company (which serves the Toano Draw area) and Raft River Electric Company (which serves the Gamble Ranch area). Power would be transmitted to the various wells by 25-kV woodpole-supported distribution lines. These lines would follow existing roads and rights-of-way as

closely as possible. Transformers located near the wells would supply power at a lower voltage to the enclosed pump houses. Power lines would run underground from the transformers to the pumphouses. Right-of-way grants for the powerlines (maximum width of 50 feet) would be applied for on a case-by-case basis. Any powerlines that would cross Federal lands would be subject to all appropriate Federal, state, and local requirements.

Existing uses of surface water and groundwater for irrigation would be progressively reduced, and ultimately terminated, to provide water for progressively increasing power plant uses, and to prevent or limit adverse environmental effects in the valley of Thousand Springs Creek that would otherwise be caused by drawdowns of the groundwater table by the wells. Also, controlled releases of stored waters in Twentyone Mile and Crittenden reservoirs would be made to prevent or limit environmental impacts downstream from the reservoirs and to limit groundwater-level declines near the stream channels.

Groundwater-level monitoring systems would be installed to detect changes, over time, caused by project-related groundwater withdrawals. Groundwater monitoring and water resource management would be conducted by Lands of Sierra, Inc. in compliance with State of Nevada standards. Results of the monitoring would be reported to the Office of the State Engineer. Well pumping plans and schedules would be adjusted to compensate for any groundwater level responses judged unacceptable by the State Engineer. Existing springs or seeps on public or private lands that could be affected by project water withdrawals would be checked periodically by the applicant, as required by the State Engineer and BLM. If specific springs or stock watering wells were lost due to project water withdrawals, alternative means for providing water to wildlife or domesticated livestock in the general area would be provided. The role of such operational-phase groundwater monitoring is discussed in more detail below.

The proposed project's plan for pumping cooling water from the Toano Draw aquifer includes a program for routinely observing a network of monitoring wells within and around the perimeter of the aquifer. If interpretation of the monitoring data (which are to be collected over a period of several years) indicates that impacts due to aquifer overdraft were occurring, measures would be determined and implemented to reduce the impacts. These measures might include reducing the pumping rate of the Toano Draw wellfields and correspondingly increasing the pumping rate of the wellfield in the Gamble Ranch vicinity. Several years of aquifer monitoring data would be needed to significantly refine the present estimate of average annual recharge to the Toano Draw aquifer, and to estimate the probable imbalance between aquifer recharge and aquifer utilization for supplying water to Units 1 and 2. At that time, the pumping rate from the Toano Draw aquifer would be adjusted, as appropriate, if it appeared that an overdraft situation were occurring.

Design features to offset the effects of pumping from the Gamble Ranch vicinity wellfield would include regulated water releases from Twentyone

Mile Reservoir and Crittenden Reservoir. Releases at relatively high rates, particularly simultaneous releases, sustained for several days at a time, would be an effective means for transferring water from the two reservoirs to Dake Reservoir, thereby maintaining water inflow to Dake Reservoir and providing surface flow in Thousand Springs Creek below Twentyone Mile Draw. These measures would benefit the wildlife and recreational resources at Dake Reservoir, and would also reduce impacts to riparian and aquatic resources along Thousand Springs Creek by maintaining the current surface flow downstream of Twentyone Mile Draw.

Monitoring of water levels in wells and springs in the Gamble Ranch area and near Dake Reservoir would be initiated as soon as possible to further define baseline hydrologic conditions in this area. Furthermore, existing springs or seeps on public or private lands that could be affected by project water withdrawals would be monitored periodically by the applicant.

If there is a loss of natural perennial surface waters (springs or seeps) shown to be caused by the applicant, on public or private lands or existing wells on public lands presently used by wildlife and livestock, water supply would be replaced by the applicant using one of the following methods:

- Rehabilitation of the well to the designed production rate by lowering the pump setting or by replacing the pump to accommodate higher pumping lifts

- Drilling and installing a new water supply well at the general location of the affected well or spring

3.1.4.5 Boiler Feedwater Treatment

The boiler feedwater makeup treatment system would receive raw water directly from the well system. The effluent from the boiler makeup treatment process would be used to replace the losses in the steam cycle and boiler blowdown. The treatment process would depend upon the quality of wellwater available. It is anticipated that this process would include lime softening, filtration, reverse osmosis, and ion exchange demineralization. In lime softening, wellwater would undergo treatment with chemicals in a clarifier-softener to remove hardness and colloidal silica. This process would be followed by filtration and demineralization. The demineralizers would consist of strongly acidic cation exchanger followed by a strongly basic anion exchanger. The final demineralizing step would be a mixed-bed ion exchange. Treated water would be pumped to the condenser hotwell or the demineralized water (condensate) storage tank. The ion exchange units would be regenerated with sulfuric acid and caustic soda. The regenerants would be pumped to a mixing tank so that the effluent from the tank would be essentially neutralized before being discharged to the ash system.

Condensate being circulated through the feedwater system would be treated in a condensate polishing system. The polisher would remove contaminants such as oxide of iron (rust) picked up by the water during startups and dissolved solids that were introduced through condenser leaks. The result would be a relatively low level of total dissolved solids in the boiler water, which would ensure production of a steam with sufficient purity to comply with turbine manufacturer standards.

Hydrazine and ammonia would be injected into the boiler to scavenge oxygen and control pH. The small amount of precipitates collected in the boiler drum would be blown down to a flash tank and the blowdown water would be delivered to the circulating water system for further use. Coordinated phosphate treatment could be used for fluidizing solids in the boiler drum.

3.2 DESCRIPTION OF ALTERNATIVES

The identification of alternatives for analysis includes alternatives that are technically feasible and that also generally meet the objectives of the applicant's proposed action. Also, the National Environmental Policy Act requires that the no action alternative be analyzed.

The alternatives considered in this analysis are grouped into five categories:

- Power Generation Alternatives
- Site Alternatives
- Project Component Alternatives
- Land Acquisition Alternatives
- No Action Alternative

Potential alternatives in each of these categories are evaluated below to determine those alternatives to be carried forward for detailed analysis. In this evaluation, the following sequential process was used: (1) identify a full range of alternatives for each category; (2) screen alternatives by determining if they would generally meet project objectives, and would be technically feasible; and (3) identify those alternatives to be carried forward for detailed analysis and those eliminated from further analysis. For those alternatives eliminated from further detailed analysis, the reasons for elimination are discussed. Alternatives carried forward for detailed analysis are analyzed in Section 5.0. The no action alternative is discussed in Section 3.2.5 and analyzed in Section 5.1.4.

3.2.1 POWER GENERATION ALTERNATIVES

In order to identify electrical generation alternatives that could generally accomplish the objectives of the project as proposed by the applicant, a sequential three-step screening process was used.

3.2.1.1 Step 1: Review Applicant's Stated Purpose and Objectives for Consideration of Reasonable Alternatives

The applicant has stated that the purpose of the proposed project is to produce 2000 MW of competitively priced baseload electric generation capacity using low-sulphur coal from Wyoming and Utah. The applicant has further stated that the proposed project would be constructed in eight phases comprised of 250-MW units each. The timing for implementation of each phased unit would be dictated by market demand for electrical power.

3.2.1.2 Step 2: Identify a Full Range of Electrical Generation Alternatives

Potential electrical generation alternatives were identified by reviewing a variety of sources including applicant planning documents, other EISs, and government energy planning documents. Alternatives identified in public and agency scoping were also included. A total of 10 categories of electrical generation alternatives were identified:

- Solar
- Wind
- Fusion
- Nuclear-fission-fueled steam-electric generators
- Geothermal
- Hydroelectric, including pumped storage
- Cogeneration
- Solid-waste energy conversion
- Natural gas/oil
- Low-sulphur coal

3.2.1.3 Step 3: Screen and Identify Those Feasible Alternatives That Could Generally Accomplish the Objectives of the Proposed Action

The purpose of this step is to identify those electrical generation alternatives carried forward for detailed analysis. First, alternatives carried forward must generally accomplish the objectives of the proposed action. Second, alternatives carried forward must be technically feasible and must comply with the Council on Environmental Quality guidelines specified in Step 1. Based on these general requirements, the following specific screening criteria were identified:

Criterion 1 - Must be consistent with U.S. policy to reduce dependence on petroleum and natural gas.

Rationale: The Power Plant and Industrial Fuel Use Act of 1978 and other actions of the U.S. government-established policy to reduce the use of oil and natural gas for electric power generation.

Criterion 2 - The electric generation alternative must be commercially available, licensable, and in operation within the period that construction of the proposed project would most likely occur. This period would

begin in 1991 (start of construction) and could extend to 2000-2010.

Rationale: If an alternative would not be technically or economically feasible within the most likely planning and construction period identified by the applicant, it cannot be included as a reasonable alternative.

Criterion 3 - The fuel or energy source for an alternative must be readily and economically available in the planning region, i.e., the State of Nevada, or could be economically transported from outside the region.

Rationale: If the fuel source is not available in sufficient quantity within the region or cannot be economically transported from outside the regional area, the applicant would not be able to meet its project objective of producing competitively priced baseload electric power.

Criterion 4 - The electric generation alternative must be capable of being constructed to supply 2000 MW of baseload generation capacity in increments of approximately 250 MW.

Rationale: In order for the applicant to construct the proposed power plant in phases as market demand dictates, alternatives would need to be installed in units of 250 MW. The use of such modules would also allow the plant to be operated in a mode that closely follows the changing demand curve.

Although the applicant has stated that coal is a desirable source of fuel for the proposed project because it is readily and economically available, Federal regulations have required the examination of other generation alternatives that would make use of energy sources other than coal. This has been done to ensure that a full range of alternatives are considered, including those that may use less-economic fuel sources but may reduce or eliminate environmental impacts or enhance the quality of the human environment. This step was carried out by applying the above screening criteria to energy alternatives identified in Step 2. Those alternatives not retained for detailed analyses are identified below along with the reasons for their elimination.

Generation Alternative: Central Station Solar-Thermal Electric or Central Station Solar-Photovoltaic.

Description. A central station solar-thermal generation alternative would consist of banks of heliostats (mirrors) keeping sunlight continually

focused on a central receiver ("power-tower"), where heat would boil water or other heat-transfer fluid to drive a conventional turbine. An alternative would use multiple receivers, but the central-receiver concept is mechanically simpler overall, most resembles conventional systems, and thus is most well developed. Another alternative would use dispersed stations to reduce weather-caused discontinuities. Land requirements would be roughly 1 to 2 square miles for every 100 MW.

A central station solar-photovoltaic generation alternative would consist of banks of photovoltaic panels, converting sunlight directly to DC current, and units for converting this to AC. The major physical limitation on total output is the availability of land; 1 square mile would yield roughly 300 MW. Output is mainly for peaking or intermediate applications. Some of the output can be considered firm capacity, since it reliably follows peak demand; weather-related interruptions could be partially dealt with by short-term storage or geographically distributed photovoltaic units. Longer-term storage would be difficult and would not be available by start of construction, i.e., 1991.

<u>Screening Results</u>: The central station solar-thermal and solar-photovoltaic were not considered for detailed analysis for the following reasons:

- To date no large-scale projects have been satisfactorily demonstrated and it is not likely that they would be available for economic commercial operation by the beginning of construction in 1991.

- Solar options are most suitable for peaking or intermediate applications and, with no backup or storage capability, would not be suitable for supplying reliable baseload generation capacity. Therefore, these options would not meet a project objective of supplying baseload electrical power.

- To provide continuous and reliable electric service, some type of backup (or storage, see below) would be required. A backup system based on coal or nuclear fuel would have high capital costs and low fuel costs. To meet the screening criteria of supplying competitively priced electrical energy, these systems (coal or nuclear) would have to run continuously.

- Storage systems consisting of batteries would not be economic or commercially available. Alternatively, pumped storage hydroelectric systems for a 2000-MW power plant are not considered viable because of a limited number of sites in northern and central Nevada with sufficient water available and water rights/ownership limitations.

- Land requirements for solar generation systems could range up to 40 square miles for solar components and additional acreage would be required for backup systems (coal, nuclear, or storage).

Generation Alternative: Central Station Wind Generation

Description. Wind-powered turbine generators have the potential for making contributions to fuel displacement. Units of up to 2.5 MW have been built and tested. Utility-scale windfarms exist at various locations. The most well-developed designs seem to be horizontal axis wind machines with a capacity of 1-4 MW. Land requirements are large and may be comparable to land requirements for solar discussed above.

Screening Results: Similar to solar electric generation, wind generators cannot be considered firm capacity due to their intermittent nature. Other problems are the lack of operating experience with wind farms and uncertain reliability. Specific reasons for not being considered for detailed analysis include requirements for storage and/or backup, are the same as discussed for central station solar discussed above.

Generation Alternative: Nuclear Fusion

Description. With this generation alternative, a steam-electric generating system would derive its thermal energy from the energy released in the fusion of certain light nuclei. Advantages relative to fission reactors include the extreme abundance of fuels, reduced radioactive inventories, and probably fewer radioactive wastes. Two fusion processes are receiving primary research emphasis: inertial confinement (laser implosion) and magnetic confinement (reactants, in high-temperature plasma state, confined within "shaped" magnetic fields). However, no fusion technology has yet been proven feasible.

Screening Results: It is unlikely that inertial confinement, magnetic confinement, or recent techniques involving heavy water and electrolysis would be commercially available by the beginning of construction or during construction of subsequent units; therefore, it was not considered for detailed analysis.

Generation Alternative: Geothermal

Description. There are several techniques or systems used for recovering geothermal energy such as dry-steam systems, hot-water systems and hot-rock systems. Of these, only dry-steam has achieved widespread commercial utilization in the U.S. While dry-steam systems offer the best potential for production of electricity, dry-steam sources are scarce. Currently, the three geothermal areas using dry-steam systems are Larderello, Italy; The Geysers, California; and Matsukawa, Japan.

As part of the development of federal procedures for utilizing geothermal resources, the U.S. Geological Survey investigated geothermal areas in the western United States, and has located and identified "Known Geothermal Resources Areas." In Nevada, there are 13 such areas. Additionally, this agency has designated a great many areas as

prospectively valuable for geothermal resources. A report prepared by the Nevada State Engineer's Office (1974) projects that in 2000, 1,280,000 megawatt-hours (MWh) of electricity will be generated, and in 2020, 2,400,000 MWh will be generated. Although the 1974 report has not been updated, the State Engineer's office feels that these estimates are optimistic based on the current level of geothermal production in Nevada (Ricci 1989). It should be noted that the estimates for 2000 or 2020 are both significantly less than the energy expected from the proposed project of about 13,000,000 MWh at full development.

Screening Results: This alternative was not considered for detailed analysis for the following reasons:

- There is no single known geothermal field in Nevada large enough to supply 2000 MW of baseload electrical generation capacity.
- If decentralized geothermal plants were an available option, transmission line requirements would be extensive, and would potentially impact a large geographic area.

Generation Alternative: Hydroelectric Including Pumped Storage

Description. Hydroelectric power generation is a well-established technology. It is reliable and suitable for both baseload and peaking generation. Its disadvantages are that it is limited to suitable sites, its availability fluctuates from year to year due to rainfall variations, and it often conflicts with recreational and other uses of rivers.

Developed conventional hydroelectric power within the State of Nevada totals 682 MW, of which 673 MW are installed at the Hoover Dam site. The undeveloped conventional hydroelectric potential within the state is very limited. Projected undeveloped capacity potential is estimated to be about 8.8 MW. In summary, about 98.7 percent of the total potential conventional hydroelectric capacity within the state is now developed. Although the terrain of Nevada may be suitable at numerous locations for installation of large-capacity pumped storage hydroelectric systems, water resources are not available for operating such systems.

Screening Results: It is unlikely that enough sites with available water could be found in the State of Nevada that could support singly or in combination increments of 250 MW or an ultimate capacity of 2000 MW. Water rights/ownership issues and regulatory lead times would contribute to lack of availability for this alternative. Based on these considerations, hydroelectric availability is not likely during the planning and construction period for the proposed project and was not considered for detailed analysis.

Generation Alternative: Solid-Waste Energy Conversion

Description. Solid-waste energy conversion refers primarily to the incineration of municipal solid waste. Other potential sources of natural organic materials for conversion to fuels and energy production include agricultural and forestry wastes and noncommercial timber. The major advantage of these resources is their renewability. The major drawbacks of these resources (insofar as electric generation is concerned) appear to be their seasonality; their low energy density and resulting need for extensive transportation from remote and scattered sources; the difficulty in obtaining reliable, long-term source contracts; and regulatory and public approval and acceptance.

Screening Results: This alternative was not considered for detailed analysis because the quantity of fuel necessary to produce 2000 MW of baseload electrical generation capacity is not available at locations within the State of Nevada. The amount that would be needed for one unit only (250 MW) would require an extensive transportation network from remote and scattered sources.

Generation Alternative: Cogeneration

Description. Cogeneration refers to the use of industrial or commercial waste heat for the generation of electricity, or the use of electric generation waste heat for industrial or commercial processes. The combination of electric generation and process heat production can be more efficient than when these activities are performed separately.

Screening Results: There is no known potential for utilizing or producing 2000 MW of commercially useful waste heat in combination with cogeneration in the State of Nevada. This alternative is, therefore, not considered for further analysis because it could not satisfy the project objective of supplying 2000 MW of baseload electrical generation capacity.

Generation Alternative: Oil or Natural-Gas-Fired Electrical Generation

Description. This alternative covers all types of electric generating units (including steam turbine, combustion turbine, combined cycle, and diesel engine units) which might be alternatives to the proposed project and which use oil or natural gas as fuels.

The U.S. collectively depends on oil and gas fuel for about 75 percent of its total energy and for about 15 percent of the nation's electricity (Daugherty 1989). Imported oil supplies approximately 50 percent of the U.S. energy needs (Ross 1989). In contrast, oil and gas make up only 3 percent of this country's fossil energy resources (Ross 1989). In response to this supply/demand imbalance, the threat of scarcity, the inflationary prices, and the uncertain availability of imported oil, the Federal government has initiated efforts to reduce oil and gas usage in noncritical applications such as electric power generation.

Screening Results: The Power Plant and Industrial Fuel Use Act of 1978 (P.L. 95-60, 29 Stat. 3289-3349, Nov. 9, 1978) has as one of its purposes "to conserve natural gas and petroleum for uses, other than electric utility or other industrial or commercial generation of steam or electricity, for which there are no feasible alternative fuels or raw material substitutes." The act states that it is U.S. policy to avoid construction of new baseload generation facilities that use oil or natural gas. This alternative was not considered for further analysis because it does not meet the criterion that it "must be consistent with national policy to reduce dependence on petroleum and natural gas" (P.L. 95-60) and is not readily available.

Generation Alternative: Nuclear Fission

Description. Nuclear plants in commercial operation in the U.S. consist of a light-water reactor (either boiling-water or pressurized-water coolant) as heat source, heat-transfer system, turbine generator, and control, safety, and other systems. The fuel used is radioactive uranium, and the technology is currently available. One of the major issues, in the context of this screening, is lead time and licensing. Current estimates of the total time for regulatory studies, licensing, construction, and startup range from 12 to 14 years. Another issue considered in this screening is the amount of water required for operation of a nuclear power plant. Conservative estimates are that the same amount of energy can be produced by fossil-fueled plants for about 5 to 10 percent less water consumption. This is a major issue in an arid region.

Screening Results: The nuclear fission power generation alternative was not considered for further analysis for three primary reasons:

- Current estimates of total lead time for regulatory studies, licensing, construction, and startup (12-14 years) could be lengthened by the current regulatory and licensing requirements in Nevada. Due to past nuclear testing and current planning to site a nuclear waste disposal area within the state, regulatory agency and public sentiment would probably extend the licensing period considerably or prevent licensing altogether. This period of licensing lead time would not permit the applicant to begin selling electricity within their anticipated time-frame.

- The applicant has stated that an objective of this project is to plan and construct 250-MW units as market conditions create the demand for additional electrical power. This cannot be accomplished with nuclear fission technology because nuclear units as small as 250 MW are not technically or economically feasible.

- Compared to other generation alternatives, water requirements for a nuclear fission plant would be relatively high. Nuclear technology would require 5 to 10 percent more water than fossil-fuel technology for the same energy production (1600-3200 ac-ft/yr).

Generation Alternative: Low-Sulphur Coal-Fired Steam-Electric

Description. This alternative (applicant's proposed action) is to construct and operate a 2000-MW baseload coal-fired steam-electric generating plant. The plant would be constructed in eight units of 250 MW each, as market demand dictates. Each unit would contain a boiler and a single-reheat turbine generator, installed in a plant building with a condenser and other station auxiliaries. The boiler, with air heaters, fans, and auxiliaries, would be located partially out of doors.

The primary fuel source for the project would be low-sulphur coal from Utah and Wyoming. The primary source of water would be groundwater from two nearby wellfields. The power plant would be designed and operated as a zero-discharge plant. Commercial operation of Unit 1 is scheduled for 1994.

Screening Results: Since this alternative is the applicant's proposed action, it meets all project objectives. In addition, it meets all other screening criteria: a reliable and economic fuel source, and capability of supplying 2000 MW of baseload capacity in increments of 250 MW; therefore, it is retained for detailed analysis.

3.2.1.4 Results of the Screening Process for Generation Alternatives
The applicant's proposed action is the only electrical generation alternative that generally meets the objectives of the proposed project and all screening criteria identified above. Therefore, it is the generation alternative that has been carried forward for detailed analysis. The screening process for alternative sites is discussed below in Section 3.2.2.

3.2.2 SITE ALTERNATIVES

In 1979, Sierra Pacific Power Company conducted a siting study to identify regions in their service area within Nevada that potentially could be developed as sites for major coal-fired power plants (WCC 1980).

Decision-making in siting major power plants is complex for several reasons: several competing objectives must be satisfied; many interest groups are involved; the time interval between when planners identify a need for a future power plant and initialize a siting study, to commercial realization of a project is long; and many future events that can have a major influence on the final site suitability are difficult to predict at the site selection stage. In addition, the National Environmental Policy Act requires that the decision-making process "...utilize a systematic, interdisciplinary approach which would insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment" (P.L. 91-190, 83 Stat. 852).

Recognizing the complexity of the siting problem, a systems analysis approach to siting was selected. The approach utilized the principles of decision analysis to integrate considerations of site safety, environmental, engineering, economic, and utility planning issues into the siting process. It involved systematically subdividing the complex problem into smaller and simpler components. These components were then analyzed individually, and logically integrated, in a manner consistent with the siting objectives and criteria, to determine which sites to select.

Procedurally, the approach involved the following:

- Definition of relevant siting issues and specification of criteria to be used in the study
- A screening process to identify candidate site regions (CSR)
- A site evaluation process to preferentially rank the CSRs. (This process required additional investigations, including field visits to identify specific site locations within the CSRs.)

Five sequential steps were conducted in the screening process:

- Screen Region of Interest to identify Candidate Regions (in the original 1980 proposal, Sierra Pacific Power Company's service area was Nevada)
- Screen Candidate Regions to identify Preliminary Candidate Areas
- Screen Preliminary Candidate Areas to identify Candidate Areas
- Screen Candidate Areas to identify Potential Site Regions
- Screen Potential Site Regions to identify CSRs

As a result of the above five steps, the screening process identified nine CSRs: three in the vicinity of Wells, Nevada, and six in other parts of the state (Figure 3.2-1).

A procedure known as decision analysis was used for the site ranking. The process consisted of the following six basic steps:

- Specify the alternative sites to be ranked
- Identify the objectives to be accomplished in choosing an alternative and a set of measures to evaluate achievement of the objectives
- Evaluate the level of achievement on each measure for each alternative site

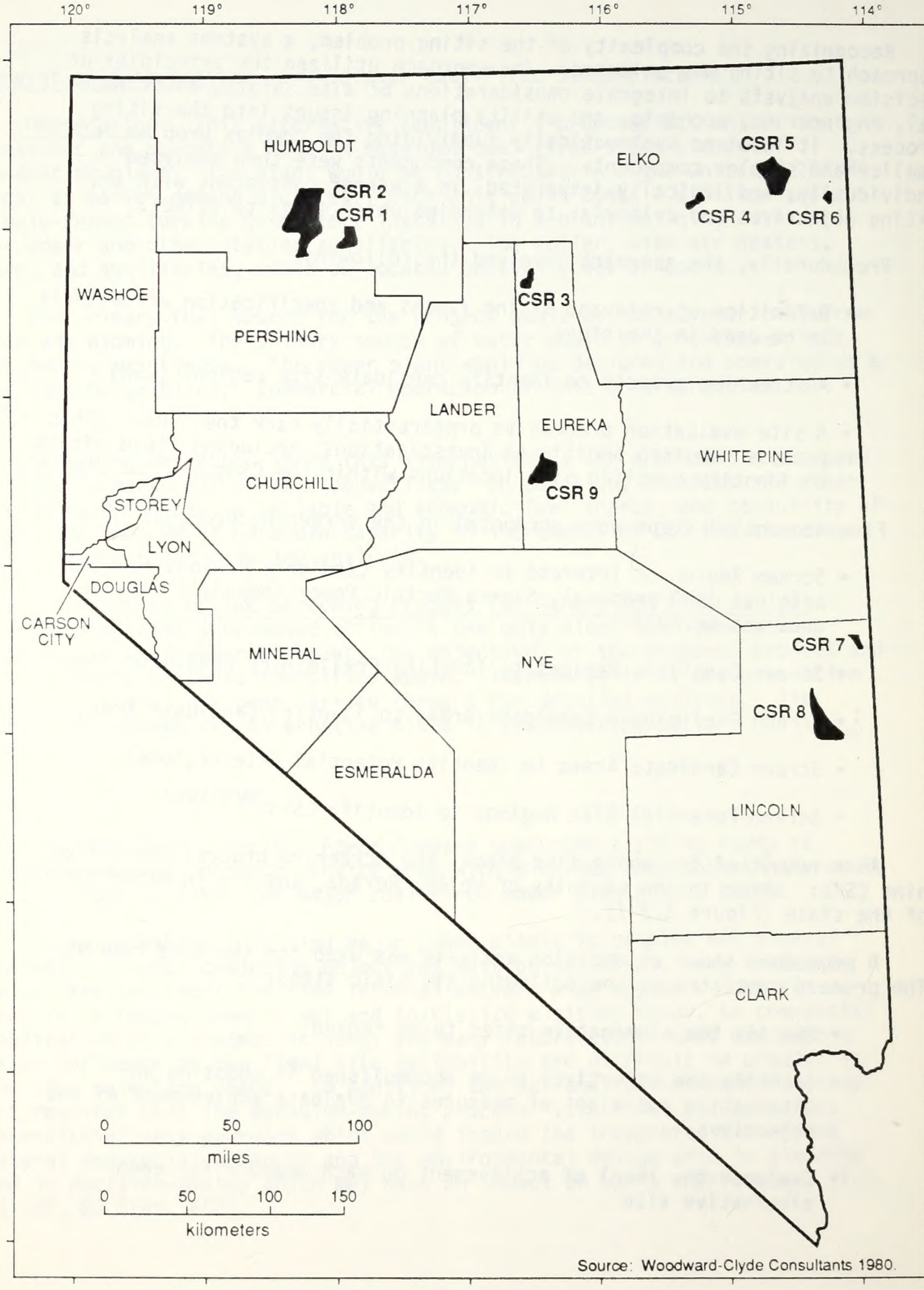


Figure 3.2-1. CANDIDATE SITE REGIONS FROM 1979 SITING STUDY

- Assess preferences over different levels of the measures

- Combine the results of Steps 3 and 4 to obtain a preliminary ranking

- Conduct sensitivity analyses to identify the effects of changes in the assumptions (preferences) and computations used in the ranking

The ranking resulted in all three Wells area CSRs being ranked higher than the other six CSRs. Factors in the ranking process which favored the Wells vicinity CSRs were as follows:

- All three Wells vicinity CSRs were near existing mainline railroads, and rail spur connections to the sites presented no significant difficulties. Connection to either of two competing railroad lines was considered to be feasible for all three sites.

- Preliminary air dispersion modeling indicated that all three Wells vicinity CSRs met the criterion for minimum acceptable air basin capacity by a considerable margin.

- Preliminary estimates of basin water resources and investigation of existing water rights in the three Wells vicinity CSRs indicated that adequate water for power plant purposes probably could be acquired within the region and no interbasin water transfers would be required.

- All three Wells vicinity CSRs were conveniently located with respect to existing electric transmission lines and/or corridors that had been designated for long-distance linear facilities.

- The Wells vicinity CSRs were as close to Utah and Wyoming coal fields as was possible to get in Nevada.

- There were no major identified environmental constraints to power plant development at any of the three Wells vicinity CSRs.

The top three ranked CSRs, all in the Wells area, were then further evaluated with respect to potential socioeconomic impacts, flooding potential, land ownership patterns, and air quality. In general, these factors were not significantly site discriminating. Finally, the Thousand Springs site was selected because the land was held by a few owners willing to sell, and water rights to support a power plant were available with the land. The project component alternatives are discussed in Section 3.2.3.

3.2.3 PROJECT COMPONENT ALTERNATIVES

Project component alternatives are discussed in this section. For those alternatives eliminated from further detailed analysis, the reasons for elimination are fully discussed. Figure 3.2-2 shows the project component alternatives carried forward for detailed analysis.

3.2.3.1 Alternative Access Road

One alternative access road was considered but was not brought forward for detailed analysis. This potential access was off of State Highway 233 (Oasis to Montello Road) starting near Cobre and traveling north-northwest to Toano Draw, approximately 17 miles, to the proposed power plant site. This alternative was dismissed because this entire route would be newly constructed road, and the potential impacts associated with constructing all new road may be too great (e.g., disturbance to vegetation, soils, cultural resources, etc.).

Two alternative access roads, in addition to the proposed access road off of U.S. 93 near Wilkins (see Section 3.1.2.14), were considered and have been brought forward for detailed analysis.

Moor Summit Access Road. This alternative access road exits I-80 near Moor Summit and travels approximately 23 miles northeast to the power plant site on existing dirt road. The route would be fenced according to BLM-specifications and access through public lands would be acquired by right-of-way grants for this alternative.

Brush Creek Access Road. This other alternative access road would be a route off of U.S. 93 starting approximately 3.5 miles south of Wilkins, and would proceed in an easternly direction for approximately 13.5 miles to the proposed plant site. This route would be fenced according to BLM-specifications and access through public lands would be by right-of-way grants for this alternative.

3.2.3.2 Alternative Coal Transportation (Railroad)

One alternative railroad route that was considered but dismissed from detailed analysis was a route off of the existing Union Pacific Railroad (UP). This route started near Wells and followed the old UP corridor north along the west side of U.S. 93 approximately 30 miles north and then east on new alignment through Thousand Springs Valley and finally south into the proposed power plant site. The length of this corridor is approximately 50 miles. This alternative was dismissed from further consideration due to potential impacts to the historic UP bed and due to the length of the route.

Another alternative railroad corridor that was considered but dismissed from detailed analysis was a route off of the existing UP mainline from the east to a turnout near Silver Zone Pass. From there, approximately nine miles of new track would be constructed, to a connection with the existing Nevada Northern Railroad (NNRR) just south of the existing Interstate 80 overcrossing of the NNRR. Approximately nine miles of the NNRR would have to be reconstructed, from the UP connection to Cobre. The NNRR presently connects to the SP mainline at Cobre. It is expected that the UP would have to construct about four miles of new track, paralleling the existing SP mainline, from Cobre to the new spur line from the SP to TSPP (the proposed action), because there is no existing joint use agreement between

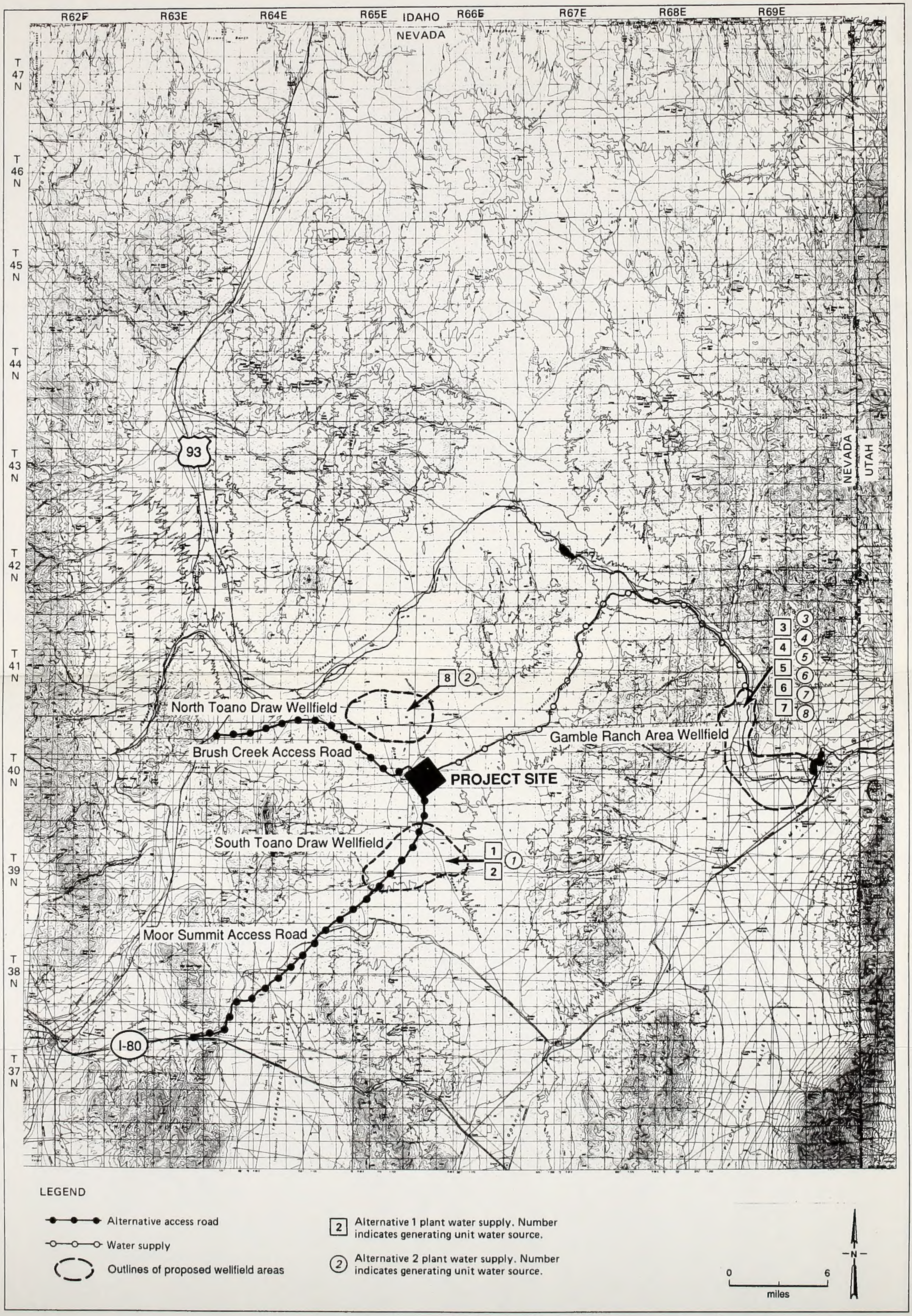


Figure 3.2-2. PROJECT COMPONENT ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEVADA STATE OFFICE
850 HARVARD WAY
P.O. BOX 12000
RENO, NEVADA 89520-0006

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
1793.1 (NV-010)

JAN 03 1990

Dear Reader:

Enclosed for your review is the Draft Environmental Impact Statement for the Thousand Springs Power Plant in northeastern Nevada. This document analyzes the Proposed Action and several alternatives involving a land exchange with the Bureau of Land Management and the subsequent construction and operation of a 2,000 mega-watt, eight-unit, coal-fired power plant on the selected lands. The alternatives discussed are designed to resolve issues that were identified through public involvement during earlier stages of the planning process.

To receive oral and written testimony, public hearings are scheduled for the following dates, places, and times:

a. January 29th in Wells in the Wells High School Auditorium on 115 Lake Avenue. 7:00 p.m. - 9:00 p.m.

b. January 30th in Elko in the Elko Convention Center on 700 Moren Way. 7:00 p.m. - 9:00 p.m.

c. January 31st in Twin Falls at the College of Southern Idaho, Shields Building, Room 118 on 315 Falls Avenue. 7:00 p.m. - 9:00 p.m.

d. February 1st in Reno at the Holiday Inn on 1000 E. Sixth Street. 7:00 p.m. - 9:00 p.m.

e. February 5th in Salt Lake City at the State Department of Natural Resources Building, 1636 W. North Temple. 7:30 - 9:30 p.m.

A written transcript of your oral presentation is encouraged to be submitted at the hearing. Your comments should be submitted before the close of business on March 12, 1990. Written comments should be sent to:

Bureau of Land Management
Elko District Office
ATTN: TSPP Coordinator
P.O. Box 831
Elko, NV 89801.

United States Department of the Interior

Dear Reader:

Following the public review and comment period, a final environmental impact statement will be prepared considering the public comments received through the review process. An abbreviated format may be used to present this information, therefore it is suggested that this copy be retained for reference purposes.

A limited number of Technical Reports for the following resources are available: Air Quality, Socioeconomic, Water, Ecological, Cultural, Soils, and Noise. These may be requested in writing from the Elko District Office at the address above.

Sincerely yours,

Fred Wolf

For EDWARD F. SPANG
State Director, Nevada

Enclosure:
Encl. 1 - Draft TSPP EIS

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A limited number of Technical Reports for the following resources are available: Air Quality, Socio-economic, Water, Geological, Cultural, Soils, and [illegible]. These may be requested in writing, from the [illegible] District Office at the address above.

Sincerely yours,

[illegible]

[illegible]

Enclosure:
[illegible]

the UP and the SP covering the existing SP mainline east of Wells, Nevada. Also, it is expected that the UP would require construction of an elevated crossing structure over the SP tracks at Cobre, and that a grade separation structure would be required at the NNRR-Highway 233 crossing.

3.2.3.3 Alternative Construction-Worker Accommodations

Two alternative locations for placing the construction worker-camp and recreational-vehicle park were considered but not brought forward for detailed analysis.

One alternative location considered was near Cobre. This alternative was dismissed when the alternative access road near Cobre to the proposed plant site was dismissed. Without that access road, a construction worker-camp near Cobre would not be a reasonable alternative to the proposed action.

Another location for the construction worker-camp and recreational vehicle park that was considered was near Wilkins. This alternative was dismissed because development of a construction worker-camp at this location would disturb an area which is otherwise totally separate from the power plant site area and because of the potential impacts associated with supplying that location with water, electricity, and sewage disposal.

The alternative brought forward for analysis is to allow the construction workers to find housing on their own.

3.2.3.4 Alternative Cooling System

Natural Draft Cooling Towers. Natural draft cooling-tower systems are generally used in relatively cool climates, where the density of the influent ambient air is sufficiently greater than that of the heated and moistened effluent air to create the necessary natural draft effect. Such a system would not be feasible for this project because of persistent high dry-bulb temperatures and low humidities during the summer. Natural draft towers are massive structures, with some towers attaining a height of 600 feet. Such towers may be considered aesthetically unacceptable because they would be visually prominent many miles from the site. For these reasons, natural draft cooling towers are not considered a reasonable alternative for the proposed project.

Cooling Ponds. Artificial ponds, or lakes, could be used as a thermal energy dissipation system. However, cooling ponds would require large land areas and would be subject to more water losses than those for cooling towers. A "rule of thumb" requires approximately 1 acre/MW or 2000 acres of ponds approximately 10 feet deep for adequate cooling with means to prevent freezing. For these reasons, cooling ponds are not considered a reasonable alternative for the proposed project.

Dry Mechanical Draft Cooling Towers. In dry-cooling-tower systems, cooling water is circulated through closed heat exchangers with large surface areas exposed to the air. Heat is dissipated by conduction and convection. Such

towers avoid problems of fogging and icing and, thus, do not have great visual impacts other than their large physical size. Also, water consumption is substantially less than that of wet-cooling towers. However, overall plant efficiency is reduced because the turbines must operate against higher condensor backpressure. Dry cooling requires a larger land area, and installed costs may be as much as 20 times the cost of mechanical draft wet-cooling systems. These drawbacks would substantially reduce the benefits of a dry-cooling system for the proposed project.

Wet/Dry Towers. A combination of wet- and dry-cooling towers would require approximately 2.5 times the land area and substantial increases in equipment items over what wet-cooling towers alone would require. The wet towers would be designed to operate mainly during the summer and the dry towers mainly during cold weather. Capabilities of these two cooling systems would be combined to condense the turbine exhaust steam in a dual-service condensor. The net result would be a power plant that could use conventional low-backpressure turbines and still meet reduced makeup-water requirements.

3.2.3.5 Alternative Plant Water Supply

Water supply alternatives that were identified are noted below. They were not considered for detailed analysis because aquifer modeling indicated they would result in large aquifer drawdowns in the vicinity of Thousand Springs Creek, and therefore, they would cause significant and probably unacceptable impacts on the natural flow in the creek starting approximately from the Winecup Ranch headquarters. These alternatives were:

- Supplying water for four generating units from either two or three wellfields to be developed in Toano Draw. Some, but not all, of the perennial recharge estimates presented in the Water Resources Technical Report indicate the perennial yield of Thousand Springs Basin, upstream from the confluence with Toano Draw, would be approximately equal to the requirements of four units.

- Supplying water for five generating units from three wellfields to be developed in Toano Draw. Water budget analyses presented in the Water Resources Evaluation Report indicated that aquifer recharge from precipitation over the subbasin plus runoff from subbasins upstream from Toano Draw and some use of available water in storage in the alluvial aquifer underlying Toano Draw would be adequate to supply up to five generating units for 35 years each.

Two plant water supply alternatives were brought forward for detailed analysis.

Alternative 1. Supply Units 1 and 2 from a wellfield south of the plant site but supply Unit 8 from a wellfield to be developed 1 to 4 miles northwest of the plant site. The wellfield to supply Units 3 through 7 would be located in the Gamble Ranch area.

Alternative 2. Supply Unit 1 from a wellfield south of the plant site but supply Unit 2 from a wellfield to be developed about 1 to 4 miles northwest of the plant site. In this case, Unit 8 would be supplied from the same wellfield that supplies Units 3 through 7, to be located in the Gamble Ranch area.

3.2.3.6 Alternative Air Emissions Control Systems

Oxides of Nitrogen. Low-NO_x burners with combustion modifications achieving a control efficiency of 55 percent and a controlled emission level of 0.45 lb NO_x/MMBtu have been selected for further environmental review. The following control technologies, listed in decreasing order of potential control efficiency, were considered but rejected.

Selective Catalytic Reduction with Ammonia. Ammonia is injected into the flue gas, upstream of a catalyst, at a point where the temperature is in the range of 650°-750°F. The ammonia reacts with NO_x to form nitrogen. This technology is capable of achieving NO_x reductions of 80 percent or better; however, to date, there have been no commercial installations of this technology on a coal-fired boiler in the U.S. Currently, as part of a 45-month demonstration project funded by the Department of Energy (DOE), the Ohio Edison Niles Power Plant is installing a 35-MW selective catalytic reduction retrofit on an existing 100-MW coal-fired plant (Chowdhury 1989). This technology is expected to reduce NO_x emissions by 90 percent or more. Since results from this technology will not be available for another 4 years, it remains unproven for this application.

Noncatalytic Reduction with Ammonia. Ammonia is injected into the flue gas at a point where the temperature is in the range of 1700°-1800°F. The ammonia reacts with NO_x to form nitrogen. This technology can achieve NO_x reductions of about 70 percent. It has been installed on coal-fired fluid bed boilers up to 50-MW capacity, but has not been installed on a utility-sized coal-fired boiler using low-sulfur western coal and is not commercially proven.

Noncatalytic Reduction with Urea. The process is identical to non-catalytic reduction with ammonia, except that the reagent is an aqueous solution of urea, which is sprayed into the flue gas. This technology can achieve NO_x reductions of 50 to 80 percent. It has not been demonstrated in continuous commercial operation on a utility-sized coal-fired boiler and is, therefore, considered unproven in this application.

Low-NO_x Burners. A Low-NO_x burner consists of two concentric annuli through which the secondary air flows around the outer coal nozzle sleeve. Turbulence is minimized in the inner annular region nearest to the fuel, while the major portion of the air is directed to the outer annular region. In this manner, oxygen availability to the fuel, in the region near the burner throat, is limited. This control technology has a control efficiency of about 50 percent, which is less than the Low-NO_x burners with combustion modification.

Flue Gas Recirculation. Combustion air is mixed with up to 18 percent of the flue gas, which acts as an inert dilutant and lowers the flame temperature. The lower temperature limits the oxidation of atmospheric nitrogen, and will yield a control efficiency of about 50 percent, which is less than either of the Low-NO_x burner options.

Fluid Bed Combustion. Fluid bed combustion will yield a control efficiency of about 50 percent but is unproven at the boiler size of this project (250 MW per module). The largest fluid bed units with significant operatin experience have capacities of approximately 100 MW, and difficulties have been experienced in scaling up the technology. Therefore, this control technology has not been considered for detailed analysis.

Sulfur Dioxide. A lime spray dryer system with a controlled emission level of 0.18 lb SO_2/MMBtu (up to 90 percent control depending on coal type) has been selected for further environmental review. The following control technologies, listed in decreasing order of potential control efficiency, were identified but not considered for detailed analysis.

Wet Scrubber with Limestone Forced Oxidation. In this process, a slurry of limestone is sprayed into the flue gas and reacts to form solid calcium sulfate (gypsum), which is dewatered and sent to a solid-waste management unit. Wet scrubbers were not considered for detailed analysis due to their high water consumption and the limitations of water at the project site.

Fluid Bed Combustion with Limestone Injection. This technology can yield a control efficiency of up to 90 percent, but, as stated above, is unproven at the boiler size of this project (250 MW per module) and, therefore, was dismissed from further analysis. Currently, the DOE is funding a 72-month demonstration project for a 256-MW circulating fluidized-bed (CFB) coal-fired boiler owned by the Southwestern Public Service Co. (Chowdhury 1989). This technology is expected to yield 70 percent capture of SO_2 from the burning of sub-bituminous coal.

Limestone Injection into Furnace. Fine crushed limestone is injected into the furnace, typically through the coal burners, where it reacts to form solid calcium sulfite/sulfate, which is removed in the flue gas PM removal system (baghouse or electrostatic precipitator). Control efficiencies are low (approximately 50 percent), which is less than selected control technology using a lime spray dryer. Therefore, this control method was not considered for detailed analysis.

Dry Lime Injection into Duct. Dry hydrated lime is injected into the flue gas duct, where it reacts to form solid calcium sulfite/surfate, which is removed in the flue gas particulate matter (PM) removal system (baghouse or electrostatic precipitator). Control efficiencies are low (approximately 40 percent), much lower than a lime spray dryer, and there are no commercial applications in the U.S. Therefore, this control method was not considered for detailed analysis.

Particulate Matter. A baghouse with reverse flow cleaning and a controlled emission level of 0.015 lb PM_{10}/MMBtu (99.8 percent control) has been selected for further environmental review. One other control technology was considered, which is capable of achieving a similar level of emission control:

Electrostatic Precipitator. The flue gas passes between electrodes maintained at a high potential, which attract and neutralize charged PM in the gas. The technology is proven, but is very sensitive to the composition of the solids, and may be adversely influenced by the reagents used for SO_2 control. A control efficiency of 99.8 percent should be achievable. This control technology was not considered because a baghouse system is preferred over an electrostatic precipitator for use with the lime spray dryer for SO_2 control and efficiency.

Carbon Monoxide. Proper burner and combustion chamber design, with a CO emission level of 0.12 lb/MMBtu (or 100 parts per million [ppm] on a dry gas basis), has been selected for further environmental review.

Catalysts. Catalysts have been used on natural gas turbine installations in California to reduce CO emissions to very low levels, typically below 10 ppm. However, they require a temperature of 1000°F and an oxygen level of 15 percent, both of which are much higher than what would be present in the flue gas of the proposed project. A large quantity of additional fuel would be required to achieve the desired catalyst temperature, which would pose an unacceptable economic burden on the project, and would further add to emissions of pollutants other than CO. In addition, catalysts are extremely expensive to install, and susceptible to poisoning by particulate matter in the gas stream. Therefore, this alternative has not been brought forward for detailed analysis.

3.2.4 LAND ACQUISITION ALTERNATIVES

The BLM has identified three distinct land acquisition procedures which could be used to obtain public land for this proposed action: land exchange, right-of-way grants, and public sale. Land exchange is the proposed procedure for obtaining public land for the proposed action. The other two procedures have been brought forward for detailed analysis in this document. Under both of these alternatives, easements would be granted across the private parcels in Toano Draw as described in the proposed action to provide for continued public access through the project area.

3.2.4.1 Right-of-Way Grants

Under the right-of-way grant alternative, BLM would retain management responsibility over the land and its ultimate reclamation. If this alternative were selected, TSGC would provide a Plan of Development for the BLM's approval. This plan would describe, in detail, the construction, operation, maintenance, and termination of the right-of-way and its associated improvements and/or facilities. The degree and scope of this plan would vary depending on the complexity of the facilities involved, but would be adequate to ascertain whether the mitigation identified in this environmental document has been followed.

Two years prior to the expected termination of any phase of this project, TSGC would contact the authorized officer to arrange a joint inspection of the right-of-way. This inspection would be held to agree to an acceptable termination (and rehabilitation) plan. This plan would include, but would not be limited to, removal of facilities, drainage structures, or surface material, recontouring, topsoiling, or seeding. The authorized officer would approve the plan in writing prior to the holder's commencement of any termination activities.

3.2.4.2 Selling of Public Lands

This alternative consists of the BLM selling the public lands outright and retaining no jurisdiction over future uses. Selling the public lands in Toano Draw would not be consistent with the BLM's land management policy as designated in the resource management plan (RMP). If this alternative were selected, this EIS would serve as the vehicle to amend the Wells RMP.

3.2.5 NO ACTION ALTERNATIVE

For the purpose of this EIS, the no action alternative is defined as the TSPP not being constructed and operated, and there would be no land tenure adjustment. The applicant, TSGC, is not a utility and would therefore not have options such as energy conservation, power purchase, modernization/retrofitting, or land management. As a result, the projected need for power within Nevada and other western, southwestern, and northwestern areas of the U.S. would be met by other public or investor-owned utilities in some other way. These alternative means of power generation could, but may not, involve public lands, depending on how the need for additional electrical supply is met.

3.3 SUMMARY OF ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Environmental impacts and recommended mitigation measures to reduce the impacts are summarized in Table 3.3-1 for construction and operation of TSPP and Table 3.3-2 for land acquisition. Unavoidable adverse impacts that would remain following implementation of the recommended mitigation, are discussed in Section 5.17. Impacts discussed in Tables 3.3-1 and 3.3-2 are those that would occur prior to implementation of the recommended mitigation.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply		Access Roads		No Construction-Worker Camp
				Alternative 1	Alternative 2	Brush Creek	Moor Summit	
AIR QUALITY								
Fugitive particulate matter (PM) emissions from construction activities.	Control by water spray and chemical stabilizers.	Localized ground-level ambient releases of short-term duration.	Fugitive dust emissions by wind erosion.	N/A	N/A	Slight increase in fugitive emissions associated with additional 45 acres of disturbance, compared to proposed action.	Increase in fugitive emissions associated with additional 160 acres of disturbance, compared to proposed action.	Slight decrease in fugitive emissions associated with a decrease of 18 acres of disturbance, compared to proposed action.
Engine exhaust emission from construction activities.	None recommended.	Low concentrations of primarily PM from diesel engines of a short-term duration.	No additional emissions from this source over existing conditions.	N/A	N/A	Slight increase in PM emissions over proposed action.	Increase in PM emissions over proposed action.	Slight decrease in PM emissions over proposed action.
Secondary growth air quality impacts (Units 1-8).	Provide worker busing to minimize exhaust emissions from private vehicles during construction and operation.	Fugitive PM emissions from construction of new housing. Additional emissions from residential heating and vehicular exhaust.	No increase over existing conditions.	N/A	N/A	N/A	N/A	Possible increase over proposed action due to construction workforce living in separate quarters.
Compliance with National and State Air Quality Standards (Units 1-8).	None recommended because Best Available Control Technology (BACT) has been incorporated in the proposed action.	In compliance	In compliance	N/A	N/A	N/A	N/A	N/A
Compliance with New Source Performance Standard (Units 1-8).	None recommended because BACT has been incorporated in the proposed action.	In compliance	In compliance	N/A	N/A	N/A	N/A	N/A
Compliance with Prevention of Significant Deterioration (PSD) Class I Increments (Units 1-8).	None recommended because BACT has been incorporated in the proposed action.	In compliance	In compliance	N/A	N/A	N/A	N/A	N/A
Visibility of landscape.	Establish a Federal and state air resources coordination group to oversee monitoring program. Institute a visibility, deposition, and PM_{10} monitoring program in the East Humboldt Wilderness Area, Jarbidge Wilderness Area, Badlands Wilderness Area, and others.	Possible decrease in visibility. Visual range reductions of 1.2 to 4.2 percent at Jarbidge Wilderness Area with eight units.	N/A	N/A	N/A	N/A	N/A	N/A

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply Alternative 1	Water Supply Alternative 2	Access Roads Brush Creek	Access Roads Moor Summit	No Construction-Worker Camp
Acid depostion.	Conduct a continuous comparison check on existing NADP/NTN sites.	Possible increase in acid deposition.	N/A	N/A	N/A	N/A	N/A	N/A
Compliance with PSD Class II Increments (Units 1-7).	None recommended because BACT has been incorporated in the proposed action.	In compliance	In compliance	N/A	N/A	N/A	N/A	N/A
Compliance with PSD Class II Increments (Units 1-8).	PSD permitting process.	Not in compliance	In compliance	N/A	N/A	N/A	N/A	N/A
Compliance with Air Quality Related Values (Units 1-8).	None recommended because BACT has been incorporated in the proposed action.	In compliance	In compliance	N/A	N/A	N/A	N/A	N/A
ECOLOGICAL RESOURCES								
Number of acres of non-wetland vegetation removed or disturbed for construction and operation of the power plant and ancillary facilities.	Designate a site representative to act as liaison with BLM for compliance with regulations and stipulations. Develop a reclamation plan to reduce surface disturbance. Vegetate disturbed areas with BLM-approved species. Replace topsoil when revegetating disturbed areas. Restrict off-road vehicle use by construction workforce.	1,780 acres	0 acres	N/A	N/A	1,825 acres	1,940 acres	1,762 acres
Increase in animal-vehicle collisions, poaching, and displacement of wildlife populations due to increased traffic, noise and human presence.	Include within the employee education program a session which addresses environmental awareness and outdoor safety. Restrict off-road vehicles and unauthorized firearms in project area. Impose a speed limit on access road. Minimize private vehicle use with worker busing. Designate a TSGC and BLM representative to act as liaison for compliance with stipulated mitigation. Construct fences a minimum of 300 feet either side of center line in key migration areas. Develop plan to minimize impacts to raptors, big game, and other species.	Approximately 400-500 migrating mule deer affected. Mule deer poaching would range from 10-35 animals annually.	No impacts.	N/A	N/A	3.5 additional miles of new access road compared to proposed action might increase opportunities for poaching/collisions. Impacts to mule deer same as proposed action.	Approximately 6,000 mule deer affected. 14 additional miles of new access road compared to proposed action might increase opportunities for poaching/collisons.	Slight decrease in noise and human presence impacts. Increase in animal-vehicle collisions as a result of more traffic.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply Alternative 1	Water Supply Alternative 2	Access Roads Brush Creek	Access Roads Moor Summit	No Construction-Worker Camp
Disturbance of known sage grouse strutting grounds by access roads, water pipelines, or wellfield powerlines.	Realign access road, water supply pipeline, or wellfield powerlines. Bury and/or make wellfield powerlines perch-proof. Implement time-of-year restriction for construction of ancillary facilities.	Three strutting grounds affected.	None affected.	N/A	N/A	Three strutting grounds affected.	One strutting ground affected.	Same as proposed action.
Interruption of mule deer migration routes by fenced access road and railroad corridors.	Do not fence access or railroad routes. If routes are fenced, construct fences a minimum of 300 feet either side of center-line and use let-down fences in key migration areas.	Approximately 500 migrating mule deer affected.	None affected.	N/A	N/A	Approximately 500 migrating mule deer affected.	Approximately 6,000 migrating mule deer affected.	Same as proposed action.
Potential acid rain impacts to sensitive receptors, i.e., mountain lakes in Jarbidge Wilderness Area.	None recommended because BACT has been incorporated in the proposed action.	Predicted deposition and pH changes are below USFS significance criteria (0.1): 0.015 and 0.061 for Emerald and Jarbidge Lakes, respectively.	Contributions from other acid rain sources inside and outside the regional area would continue.	N/A	N/A	N/A	N/A	N/A
Curtailment of irrigation on existing irrigated lands resulting in changes in vegetation species composition.	Eliminate cattle use on all or selected areas of converted wetland habitats. Reseed fallow croplands to native species.	Approximately 3,200 acres of hay meadow would revert to alkali meadow with no loss of jurisdictional wetlands. Approximately 566 acres of alkali meadow would revert to upland shrub. Potential loss of jurisdictional wetlands. Further potential loss in quality of converted wetland habitats by livestock grazing.	No change in impacts.	Little increase in impacts to wetlands/riparian vegetation because of limited distribution between Toano Draw and Twentyone Mile Draw.	Increase in potential for impacts to marsh complex near Dake Reservoir during extended dry periods.	N/A	N/A	N/A
Sustained pumping of the Gamble Ranch wellfield during extended dry periods could reduce water inflow to marsh complex in Dake Reservoir vicinity.	Monitor shallow groundwater in Dake Reservoir area. Exclude livestock use on all or selected wetland areas. Reestablish marsh complex vegetation where water supply is available. Reclaim drained marshes. Fence marsh complex near Dake Reservoir to exclude livestock use. Establish shallow ground-water monitoring wells in wetlands. If wetland/riparian habitats are lost, reestablish habitats similar to those affected.	Approximately 850 acres of marsh complex including marsh and wet meadow could revert to alkali meadows during extended dry periods and sustained pumping of the Gamble Ranch wellfield.	Marsh complex would not be affected during minor or moderate droughts, but could be affected during extreme drought.	Same as proposed action.	Impact area would be the same as proposed action. Impact magnitude could be greater, i.e., marsh complex could be affected sooner because of larger drawdowns.	N/A	N/A	N/A

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply: Alternative 1	Water Supply: Alternative 2	Access Roads: Brush Creek	Access Roads: Moor Summit	No Construction-Worker Camp
Streamflow downstream from Crittenden Creek and water levels in Dake Reservoir could be reduced significantly during extended dry period due to pumping of the Gamble Ranch wellfield.	Mitigation would not be possible since extended dry period would prevent controlled releases to Thousand Springs drainage basin. Agreements should be developed between the applicant, NDOW, and BLM to consider merits of controlled releases versus minimum pool during dry periods.	Loss of fish populations in Thousand Springs Creek and Dake Reservoir.	Streamflow and Dake Reservoir water levels would not be appreciably affected except during extreme drought conditions.	Streamflow to Dake Reservoir same as proposed action.	Same as Alternative 1.	N/A	N/A	N/A
Impacts to birds from exposure to wastewater ponds.	Monitor impacts to birds from exposure to wastewater ponds and initiate appropriate mitigation as necessary. Migitation could include the use of hazing devices, installing netting over the ponds, or other appropriate preventative measures authorized in cooperation with the Nevada Department of Wildlife.	Spread of disease and infection.	No impacts.	N/A	N/A	N/A	N/A	N/A
WATER RESOURCES								
Potential impacts from sewage disposal during construction and operation activities.	Construct a package sewage treatment plant.	Possible spread of bacteria and disease from wind dispersion off of wastewater ponds or dried pond areas.	No impacts.	N/A	N/A	N/A	N/A	N/A
Potential release of hazardous materials.	Develop hazardous materials management and contingency Plan. Implement and monitor to prevent and detect releases.	No significant releases to water bodies are anticipated. Applicant would have complete liability regardless of land ownership.	No impacts.	N/A	N/A	N/A	N/A	N/A
Drawdowns in groundwater levels due to pumping in the Toano Draw wellfield for supply of Units 1, 2, and 8.	Water level monitoring to detect overdraft. If overdraft were indicated by monitoring, the pumping rate and location would be adjusted to not exceed the long-term renewable resources of the subbasin. Construct wildlife troughs 1 mile apart off the proposed water line from wellfield.	Maximum drawdowns in the Toano Draw wellfield area for Units 1, 2, and 8 would be approximately 70 feet. No significant groundwater-level drawdown along Thousand Springs Creek (10 feet or less), based on 35 years or pumping at 12,000 ac-ft/yr.	Groundwater levels would remain approximately at current levels (groundwater basin is essentially full).	Maximum drawdown in the vicinity of Thousand Springs Creek would be 15-20 feet.	Less impact on Toano Draw alluvial aquifer.	N/A	N/A	N/A

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply: Alternative 1	Water Supply: Alternative 2	Access Roads: Brush Creek	Access Roads: Moor Summit	No Construction-Worker Camp
Drawdown in groundwater levels due to pumping in the Gamble Ranch wellfield for Units 3-7.	Same as above for the Toano Draw wellfield.	Maximum drawdowns in Gamble Ranch well-field area would be approximately 40 feet. Maximum drawdowns in the area near Dake Reservoir after 35 years of pumping at a rate of 20,000 af/yr would be 8-12 feet, based on 35 years of pipeline at 12,000 ac-ft/yr. During extended dry periods Dake Reservoir could be emptied completely.	Same as for the Toano Draw wellfield.	Same as proposed action.	Greater impact on the aquifer in the Gamble Ranch vicinity.	N/A	N/A	N/A
Increased erosion by runoff due to construction of power plant, roads, rail spur, or pipelines and transmission line.	Revegetation of disturbed areas, use reshaping to limit and control erosion. Locate construction lay-down areas and vehicle maintenance activities away from stream crossings.	No significant impacts expected based on proposed project design features.	No impacts.	Same as proposed action.	Same as proposed action.	Greater impacts than proposed action.	Greater impacts than proposed action.	N/A
Reduction of groundwater discharge to Utah through the upper alluvial aquifer.	None recommended.	Reduction of discharge to Utah of about 17,000 ac-ft/yr would not affect Great Salt Lake Basin because a stable or receding lake level may be preferred given recent high lake levels.	Historic discharge to Utah would continue.	Same as proposed action.	Same as proposed action.	N/A	N/A	N/A
Reduced streamflow in Thousand Springs Creek and existing springs around the perimeter of the Toano Draw and Gamble Ranch wellfields. Increase in pumping lifts of existing stock-watering wells.	A series of monitoring wells and key springs would be observed to determine if specific mitigation measures might be necessary. If significant impacts are observed or are judged to be imminent, the applicant should work with the State Engineers Office, NDOW, and the BLM to define and negotiate appropriate mitigation measures.	Approximately six springs could show reduced discharge in the Toano Draw and Gamble Ranch wellfields vicinities. Reduced streamflow expected during extended dry periods when controlled releases cannot be maintained.	Streamflow and discharge from springs would remain at current levels.	Less potential for reduced flow from springs at the southern end of Toano Draw Sub-basin.	Same as Alternative 1 except slight increase in potential for reduced streamflow.	N/A	N/A	N/A

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply		Access Roads		No Construction-Worker Camp
				Alternative 1	Alternative 2	Brush Creek	Moor Summit	
GEOLOGY								
Risk for strong ground-shaking and associated impacts to structures.	Conduct geotechnical studies and design structures accordingly.	Potential impacts to structures if not designed to appropriate seismic standards.	No impacts.	N/A	N/A	Same as proposed action.	Same as proposed action.	No impacts.
Risk of flooding from maximum credible storm events and associated impacts to structures.	Design facilities and road for maximum credible flooding (100-year flood event).	Potential impacts to facilities and roads if not designed for maximum credible flooding.	No impacts.	N/A	N/A	Same as proposed action.	Same as proposed action.	No impacts.
Risk for hydrocompaction, subsidence, and settlement, and associated impacts to structures.	Conduct geotechnical studies and design structures accordingly.	Potential impacts to structures if not designed for potential settlement.	No impacts.	N/A	N/A	Same as proposed action.	Same as proposed action.	No impacts.
SOILS								
Number of acres of topsoil disturbed.	Develop reclamation plan to lessen soil loss and restore natural vegetation.	1780 acres	No impacts.	N/A	N/A	An additional 45 acres over proposed action.	An additional 160 acres over proposed action.	A decrease of 18 acres from proposed action.
NOISE								
Exceedance of acceptable noise levels at sensitive receptors.	Noise reduction methods recommended at construction-worker camp. Relocate the construction-worker camp. Conduct a noise monitoring program to ensure compliance with standards.	Exceedance of acceptable noise levels at construction-worker camp by 2 dBA and with possible hearing-related impacts.	No impacts.	N/A	N/A	No impacts.	No impacts.	No impacts.
VISUAL RESOURCES								
Significant contrast to existing landscape.	Situate structure to minimize visual impact. Select color of building materials and/or paint to minimize contrast to existing landscape. Include visual resource considerations in reclamation plan.	Plant site is VRM Class IV area - structures allowed to dominate landscape.	No impacts.	Minimal impact from wellfield powerlines.	Minimal impact from wellfield powerlines.	Minimal impacts.	Minimal impacts.	No impacts.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply		Access Roads		No Construction-Worker Camp
				Alternative 1	Alternative 2	Brush Creek	Moor Summit	
RECREATIONAL RESOURCES								
Increased hunting and fishing pressures. Increased use of recreational sites and parklands.	Implement periodic environmental training for ORV use, firearms and safety, hunting regulations, wilderness use and ethics, and developed recreation site use and ethics. Provide additional acreages to surrounding communities (Wells, Elko, Jackpot, Twin Falls) for city parks and recreational facilities.	The deficiency in fishing streams presently at 6:1 (a ratio of need to availability in miles) would increase by 25% to 8:1. Crowding would occur at existing municipal parks in local communities during high use periods, especially in Elko and Jackpot. Recreational use would increase by an additional 56,900 visitor hours annually.	Existing use would continue.	N/A	N/A	Same as proposed action.	More use of parks in Elko, Wells, and Wendover than with proposed action.	Similar but probably greater impacts than with proposed action.
CULTURAL RESOURCES								
Potentially significant impacts to known cultural resources.	Section 106 process of NHPA. Implement employee education program regarding the value and protection of cultural resources.	Proposed access road crosses Emigrant Trail.	No impacts.	No known significant cultural resources.	No known significant cultural resources.	This alternative access road crosses and/or parallels Emigrant Trail.	Numerous historic Chinese sites along this access road.	No impacts.
PALEONTOLOGICAL RESOURCES								
Potentially significant impacts to known or suspected paleontological resources.	Evaluation and mitigation as necessary.	Potential impacts to known paleontological resources.	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.	No impacts.
LAND USE								
Net loss in grazing preference (AUMs). Eliminating irrigation of pasture and hay lands would change livestock operations and grazing practices.	None recommended.	Approximately 88 AUMs would be lost from public lands.	No change.	Minimal loss.	Minimal loss.	Approximately 13 AUMs would be lost from public lands.	Approximately 26 AUMs would be lost from public lands.	Approximately 86 AUMs would be lost from public lands.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	No Construction-Worker Camp	Moor Summit: Construction-Worker Camp	Moor Summit: No Construction-Worker Camp	Brush Creek
SOCIOECONOMICS							
Employment and Income Increase in local communities providing primary and secondary jobs and revenues.	None required.	Increased employment and revenues in local communities, especially Elko, Twin Falls, Wells, and Jackpot. During the peak construction period, as many as 375 additional support jobs could be generated. As many as 420 additional indirect or support jobs are associated with the operation workforce. The annual wage for construction workers would be double the average annual wage in Elko County ($17,441). Revenues to local communities associated with workers' expenditures are estimated to be $6.5 million annually. Approximately $138,000 in sales tax revenues would be generated in the communities annually.	Effects of local mining activity to continue.	Similar amount of jobs would be created as with proposed action. During the peak construction period, as many as 375 additional support jobs could be generated.	Similar amount of jobs as with the proposed action, although more secondary jobs in Elko, Wells, and Wendover rather than Jackpot and Twin Falls.	Same as with Moor Summit with construction-worker camp.	Same as proposed action.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	No Construction-Worker Camp	Moor Summit: Construction-Worker Camp	Moor Summit: No Construction-Worker Camp	Brush Creek
Population increase in local communities creating demand for housing and schools.	Applicant to retain a liaison to provide communities with information regarding construction schedule and workforce projections for planning purposes. Applicant to prepay taxes so City of Wells can hire a planner. Applicant to partially prepay taxes to provide school facilities.	Potentially significant impact to community of Wells because of lack of housing and services to accommodate influx of population. Other communities probably capable of absorbing additional population. Project-associated population in Elko is projected to increase from 1 to 3 percent, and population in Wells is projected to increase from 2 to 11 percent. Demand for housing in Elko associated with the project would be 3 percent of the current housing stock and 8 to 11 percent of the existing housing stock in Wells Elko would require 2 new classrooms, and Wells would require 3-4 to accommodate project-related increases in school children population in 2000. One additional law enforcement officer would be needed in Elko to satisfy need, although Wells has sufficient forces currently in place. At Elko General Hospital, one physician would be required to offset project-related demand. It is estimated that Wells would require one physician's assistant or nurse practicioner and replacement of existing medical building.	No additional demand for community services or housing.	Population increase associated with construction workforce in the local communities would be far greater than with the proposed action, exacerbating the impacts identified for the proposed action.	Population increases and service demands greater for Elko, Wells, and Wendover and less for Twin Falls and Jackpot than with the proposed action.	Similar but greater impacts to communities as those identified for Moor Summit with construction-worker camp.	Same as proposed action.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (continued)

Impact Category	Recommended Mitigation	Proposed Action	No Action	No Construction-Worker Camp	Moor Summit: Construction-Worker Camp	Moor Summit: No Construction-Worker Camp	Brush Creek
Property and sales tax revenues increase in local jurisdictions.	None required.	Increased revenues for county and local communities. If the proposed project is valued and taxed as a project proposed by a private entity wholly located in Elko County, the property tax to the county would be $2.9 million for the first unit. If the project is treated as a centrally assessed property, the county would receive a $72,500 in revenue. Elko County would receive $5.7 million in sales and use tax revenue for every unit that was constructed. By the year 2000, the county would be paid approximately $22.8 million in sales and use tax revenue and $11.6 million annually in property tax revenue.	Tax revenues from proposed project would not occur.	Property and sales tax revenues would be similar to those associated with the proposed action.	Property and sales tax revenues from salaries would be greater in Elko, Wells, and Wendover than in Twin Falls and Jackpot than with the proposed action.	Similar impacts as identified for Moor Summit with construction-worker camp.	Same as proposed action.

Table 3.3-1. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION MEASURES FOR CONSTRUCTION AND OPERATION OF THOUSAND SPRINGS POWER PLANT (concluded)

Impact Category	Recommended Mitigation	Proposed Action	No Action	Water Supply		Access Roads		No Construction-Worker Camp
				Alternative 1	Alternative 2	Brush Creek	Moor Summit	
TRANSPORTATION								
Decrease in level of service on existing roads.	Provide busing to and from the project site. Encourage car-pooling of workers and reschedule material deliveries during inclement weather.	Minor decrease in level-of-service to State Highway 93.	No change.	N/A	N/A	Same as proposed action.	No change.	Greater decrease in level-of-service on State Highway 93 than with proposed action.
Deterioration of BLM roads due to increased population and vehicle use.	Establish a fund to help maintain BLM roads in the study area.	Potential deterioration to BLM roads.	No change.	N/A	N/A	Same as proposed action.	Same as proposed action.	Same as proposed action.

Table 3.3-2. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION FOR LAND ACQUISITION

Impact Category	Recommended Mitigation	Proposed Action	Alternatives: No Action	Alternatives: Right-of-Way Grants	Alternatives: Selling the Public Lands
AIR QUALITY					
Degradation of existing ambient air quality.	None recommended.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.
NOISE					
Increase in noise levels over existing conditions.	None recommended.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.
GEOLOGIC CONSIDERATIONS					
Possible mining activity and associated impacts.	Develop and implement a reclamation plan under Assembly Bill No. 958.	Possibility of locatable mineral reserve mining on offered lands which would come under public management.	Possibility of relocatable mineral reserve mining on offered lands but lands would remain in private ownership.	No Impacts Identified.	No Impacts Identified.
SOILS					
Increased chance for erosion of soils with poor reclamation potential.	Implement a soils reclamation plan.	Approximately 12,770 acres of soils with poor reclamation potential would come under public domain. BLM could manage the lands to lessen disturbance by private entities for activities other than mining.	Approximately 12,740 acres of soils with poor reclamation potential would remain in private ownership. Chance of disturbance of these soils would remain the same as present.	Approximately 1,780 acres of soils with characteristics sensitive to disturbance would become subject to land disturbing activities.	Approximately 1,780 acres of soils with characteristics sensitive to disturbance would become subject to land disturbing activities.
WATER RESOURCES					
Impacts to water quality or quantity.	None recommended.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.	No Impacts Identified.

Table 3.3-2. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION FOR LAND ACQUISITION (continued)

Impact Category	Recommended Mitigation	Proposed Action	Alternatives: No Action	Alternatives: Right-of-Way Grants	Alternatives: Selling the Public Lands
ECOLOGICAL RESOURCES					
Loss or gain of habitat for game or other important wildlife species.	None recommended.	Net gain of 6,405 acres of mule deer habitat and a net loss of 1,479 acres of elk habitat, net loss of 156 acres of antelope habitat, and net loss of 160 acres of sage grouse habitat under BLM management. Net gain of 8.1 miles of additional stream habitat under BLM management.	Wildlife habitat would remain under present management.	Net loss of approximately 1,780 acres of habitat under BLM management.	Net loss of approximately 1,780 acres of habitat under BLM management.
CULTURAL RESOURCES					
Significant impacts to known or suspected cultural resources.	NHPA Section 106 Process.	Several hundred identified cultural resources would come under private management and some would be subject to disturbance. An unidentified number would come under BLM management.	Impacts to cultural resources would remain the same as present.	An unidentified number of cultural resources would come under private management and subject to disturbance.	An unidentified number of cultural resources would come under private management and subject to disturbance.
PALEONTOLOGICAL RESOURCES					
Significant impacts to known or suspected paleontological resources.	None recommended.	No impacts identified.	No impacts identified.	No impacts identified.	No impacts identified.
VISUAL RESOURCES					
Net loss or gain of higher VRM class lands and/or higher scenic quality lands.	None recommended.	Net loss of approximately 80 acres of VRM Class II lands and 1,500 acres of VRM Class III lands. Net increase of higher scenic quality lands.	No impacts identified.	No impacts identified.	No impacts identified.

Table 3.3-2. SUMMARY OF ENVIRONMENTAL IMPACTS AND RECOMMENDED MITIGATION FOR LAND ACQUISITION (concluded)

Impact Category	Recommended Mitigation	Proposed Action	Alternatives: No Action	Alternatives: Right-of-Way Grants	Alternatives: Selling the Public Lands
RECREATIONAL RESOURCES					
Net increase or decrease in higher quality recreational lands.	None recommended.	Net increase in higher quality recreational lands under BLM jurisdiction.	No impacts identified.	No impacts identified.	No impacts identified.
SOCIOECONOMICS					
Impacts to social or economic issues.	None recommended.	No impacts identified.	No impacts identified.	No impacts identified.	No impacts identified.
LAND USE					
Changes in land status.	None recommended.	By creating large contiguous blocks of Federal and private lands, management of these lands is made easier. Transfers 15,962 acres of selected lands in the Toano Draw to private ownership in exchange for 12,774 acres of offered lands in the Snake Mountains and 640 acres of offered lands in Toano Draw to public ownership.	No impacts identified.	Approximately 1,780 acres of public lands would be granted as rights-of-way and would be removed from public use for the projected plant life (i.e., approximately 49 years).	Approximately 1,780 acres of public lands would be sold and would be removed from public use permanently
Conflict with existing plans or policies.	For ROW alternative, relocate proposed landfill onto private land.	No impacts identified	No impacts identified.	Locating landfills on property that could revert back to Federal management is against BLM policy.	No impacts identified.
Changes to grazing permits.	None recommended.	The land exchange would have an effect on four allotments resulting in an increased grazing capacity under BLM jurisdiction of 1,553 AUMs. See geology for impacts on mineral extraction.	No change from current use.	Loss of 140 AUMs.	Loss of 140 AUMs.
TRANSPORTATION					
Impacts to traffic circulation.	None recommended.	No impacts identified.	No impacts identified.	No impacts identified.	No impacts identified.

4.0 AFFECTED ENVIRONMENT

This section describes the existing environmental conditions and present trends in the project area.

The affected environment has been described in each of the resource areas to encompass the three components of the proposed action: land acquisition, construction, and operation of the power plant. The extent of the affected environment evaluated, or study area, can differ between resource areas. Study areas were determined by geographic extent of anticipated project-related impacts. Topographic features, geographic locations, and water bodies referred to in this section and Section 5.0 are shown in Section 12.0 on Figures 12.0-1 and 12.0-2.

Studies of the affected environment for the proposed action and alternatives have been considered for each of the following topics:

- Air Quality/Meteorology
- Noise
- Geology
- Soils
- Water Resources
- Ecological Resources
- Cultural Resources
- Paleontological Resources
- Visual Resources
- Recreation
- Socioeconomics
- Land Use
- Transportation

4.1 AIR QUALITY

4.1.1 STUDY AREA DEFINITION

The proposed Thousand Springs Power Plant (TSPP) would be located in northeastern Nevada within Toano Draw. This valley is 22 miles long and up to 15 miles wide. The elevation at the power plant site is approximately 5700 feet. Toano Draw is bounded by the 7400-foot Knoll Mountains to the northwest, the 7900-foot Windermere Hills to the west, the 8100-foot Pequop Mountains to the southwest, the 7900-foot Toano Range to the southeast, the

8400-foot Gamble Range to the east, and the 7400-foot Ninemile Mountain to the northeast.

The study area for air quality includes the above-described region. In order to comply with the requirements of the Clean Air Act and National Environmental Policy Act (NEPA), the air quality study area is defined by an area bounded by the maximum extent of a "significant" impact. "Significant" impact levels have been defined by the Environmental Protection Agency (EPA) as specific pollutant concentrations below which no interference with an ambient air quality standard is assumed, even in areas where a standard is currently being violated. These concentration levels are given in Table 4.1-1.

For the purposes of the EIS, the largest area within an annual average 1 $\mu g/m^3$ isopleth (line of constant concentration) for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), or total suspended particulate matter (TSP) is used to represent the calculated study area. Based on air quality modeling results, the largest annual average 1 $\mu g/m^3$ isopleth was for NO_2. Figure 4.1-1 shows the predicted study area (1 $\mu g/m^3$ isopleth for NO_2) for the proposed TSPP project. This entire area is classified as Prevention of Significant Deterioration (PSD) Class II. Figure 4.1-1 also shows other wilderness areas and wilderness study areas in the region that the U.S. Forest Service (USFS) and BLM have identified to be of concern with respect to potential air quality impacts from the proposed TSPP. Table 4.1-2 provides a list of the wilderness areas shown on Figure 4.1-1 and their current status. In addition, there is one PSD Class I area, Jarbidge Wilderness Area, located within 100 kilometers (km) (62 miles) of the proposed TSPP. Emissions from the proposed TSPP could pose a potential impact to this Class I area, thus it is a special area of concern and detailed air quality and Air Quality Related Value (AQRV) analyses were performed.

Typically, the EPA and State of Nevada only requires a detailed air quality and AQRV analysis for Class I areas if a proposed PSD source plans to locate within 100 km of it. The next closest Class I area or proposed Class I area from the TSPP site is Craters of the Moon National Monument (about 240 km from TSPP). In addition to Craters of the Moon, there are a number of additional Class I areas beyond 100 km from the proposed TSPP site along with the wilderness areas within 100 km of the site. Figure 4.1-2 shows the Class I areas where visibility is an important value that are within 300 miles (500 km) of the proposed TSPP site along with the wilderness areas within 100 km of the site. A number of these Class I areas were also evaluated for potential air quality effects from TSPP emissions. The approximate distances from the proposed TSPP site to each of the areas shown on Figure 4.1-2 are given in Table 4.1-3.

Emissions of carbon dioxide (CO_2) from the proposed TSPP are also of concern (i.e., the "Greenhouse Effect"). These impacts may be of a global nature and as such, no specific study area was defined.

Table 4.1-1. EPA SIGNIFICANCE LEVELS FOR AIR QUALITY IMPACTS

	Averaging Time				
Pollutant $\mu g/m^3$	Annual ($\mu g/m^3$)	24-hour ($\mu g/m^3$)	8-hour ($\mu g/m^3$)	3-hour ($\mu g/m^3$)	1-hour ($\mu g/m^3$)
Sulfur Dioxide (SO_2)	1	5	--	25	--
Total Suspended Particulates (TSP)	1	5	--	--	--
Nitrogen Dioxide (NO_2)	1	--	--	--	--
Carbon Monoxide (CO)	--	--	500	--	2000

Source: 40 CFR Part 51, Appendix S.

Table 4.1-2. WILDERNESS AREAS AND CURRENT DESIGNATION IN PROJECT AREA

Forest Service	Status
East Humboldt	WA
Jarbidge	WA[a]
Jarbidge Extension	WA
Ruby Mountains	WA
Bureau of Land Management (BLM)	**Status**
Bluebell	WSA
Goshute	WSA
South Pequop	WSA
Badlands	WSA
Rough Hills	WSA

[a] = PSD Class I Area
WA = Wilderness Area
WSA = Wilderness Study Area

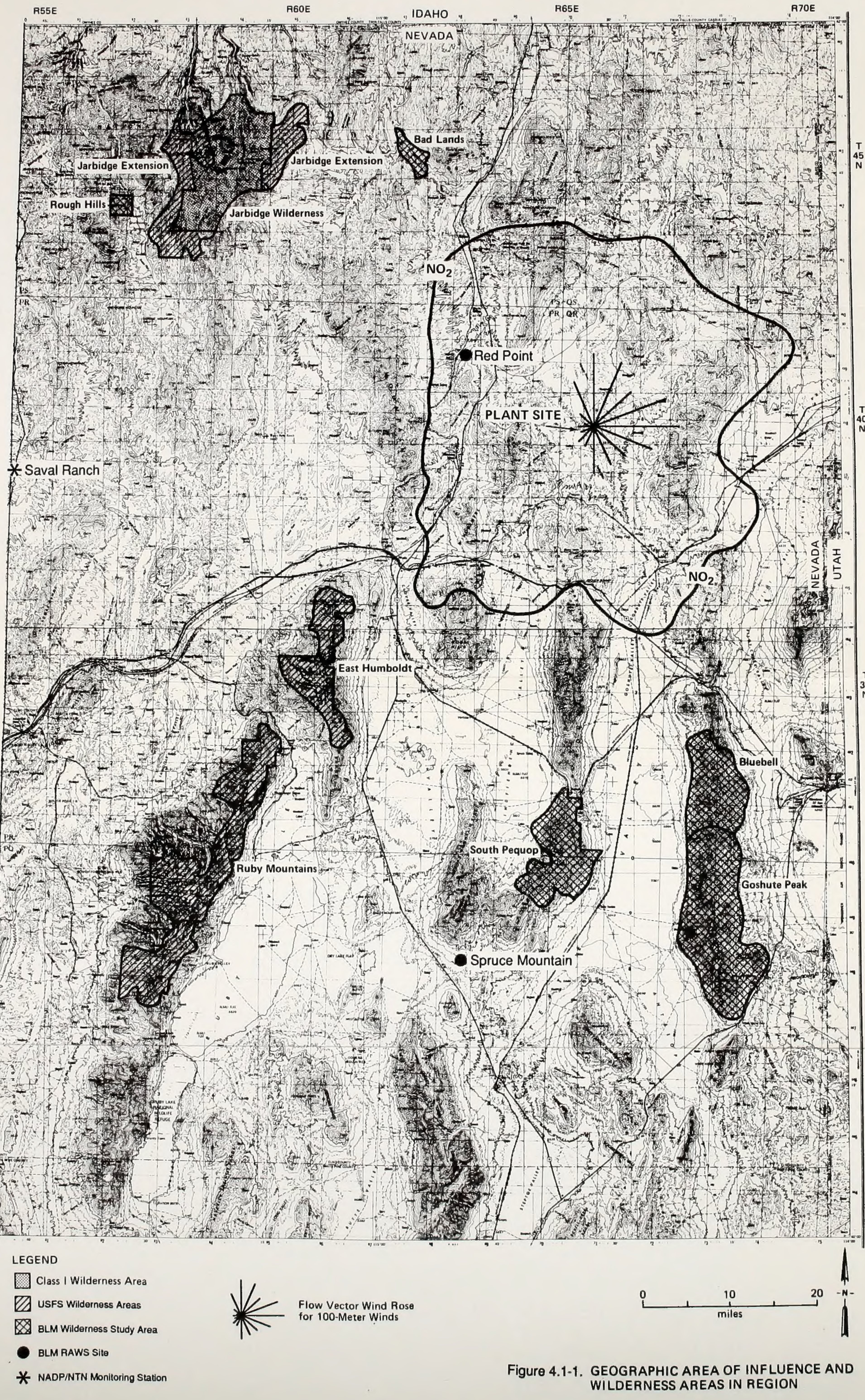


Figure 4.1-1. GEOGRAPHIC AREA OF INFLUENCE AND WILDERNESS AREAS IN REGION

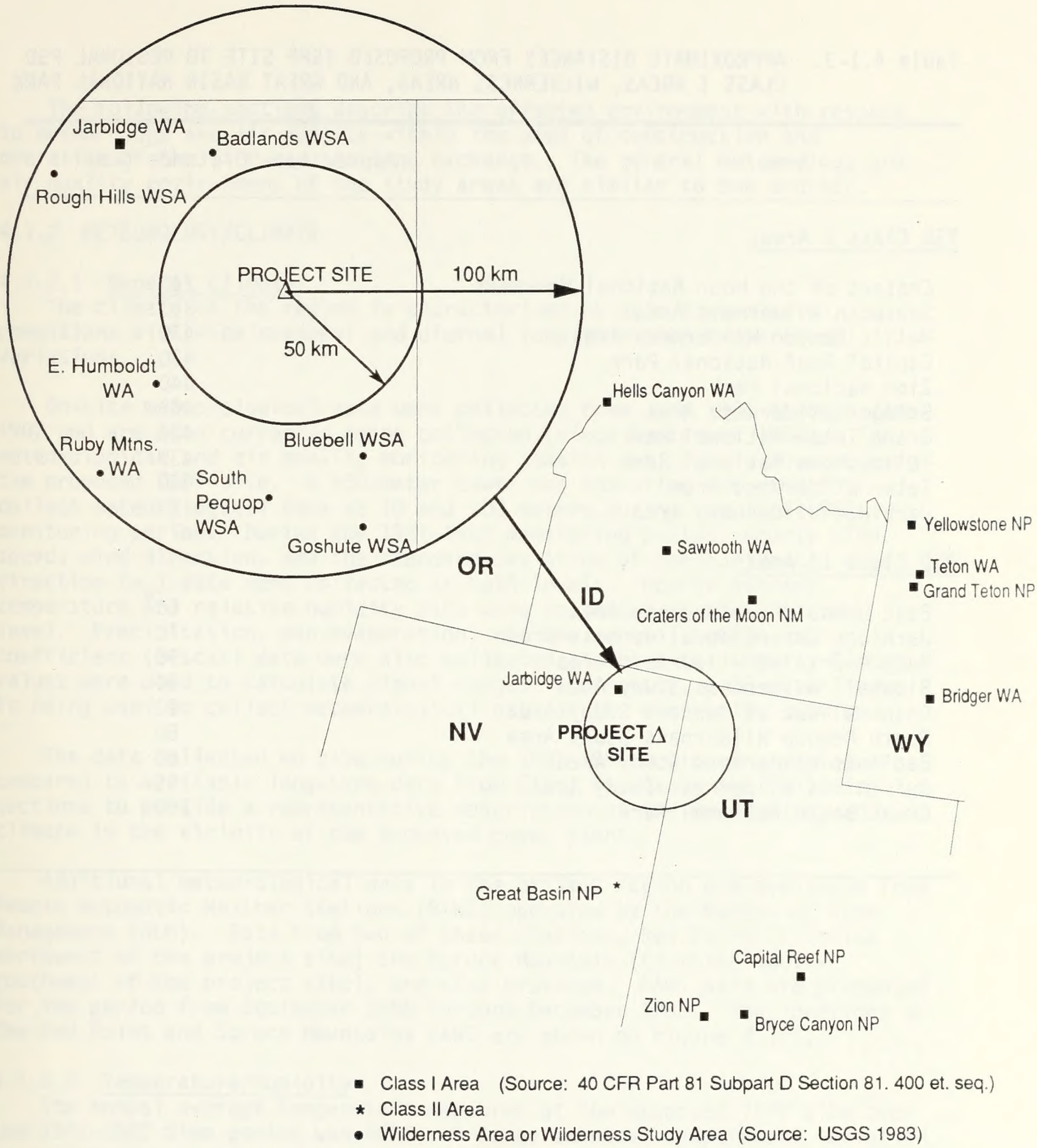


Figure 4.1-2. WILDERNESS AREAS AND WILDERNESS STUDY AREAS OF CONCERN IN THE PROJECT REGION (INSET) AND MANDATORY CLASS I AREAS WHERE VISIBILITY IS AN IMPORTANT VALUE WITHIN APPROXIMATELY 300 MILES (500 KILOMETERS) OF THE TSPP SITE

Table 4.1-3. APPROXIMATE DISTANCES FROM PROPOSED TSPP SITE TO REGIONAL PSD CLASS I AREAS, WILDERNESS AREAS, AND GREAT BASIN NATIONAL PARK

Area	Approximate Distance (km)
PSD Class I Areas	
Craters of the Moon National Monument	240
Sawtooth Wilderness Area	310
Hell's Canyon Wilderness Area	470
Capitol Reef National Park	430
Zion National Park	440
Bridger Wilderness Area	460
Grand Teton National Park	400
Yellowstone National Park	430
Teton Wilderness Area	480
Jarbidge Wilderness Area	75
PSD Class II Areas	
East Humboldt Wilderness Area	60
Jarbidge Extension Wilderness Area	70
Ruby Mountains Wilderness Area	90
Bluebell Wilderness Study Area	70
Goshute Peak Wilderness Study Area	90
South Pequop Wilderness Study Area	80
Badlands Wilderness Study Area	60
Ruff Hills Wilderness Study Area	95
Great Basin National Park	260

The following sections describe the affected environment with respect to meteorology and air quality within the area of construction and operation of the TSPP and the land exchange. The general meteorology and air quality environment of the study areas are similar to one another.

4.1.2 METEOROLOGY/CLIMATE

4.1.2.1 General Climate

The climate of the region is characterized by arid-to-semiarid conditions with wide seasonal and diurnal (day to night) temperature variations.

On-site meteorological data were collected from June 1981 through June 1982 and are also currently being collected (since September 1988). The meteorological and air quality monitoring station was, and is located near the proposed TSPP site. A 100-meter tower was installed and used to collect meteorological data at 10 and 100 meters during the 1981-1982 monitoring period. During the 1981-1982 monitoring period, hourly wind speed, wind direction, and the standard deviation of the horizontal wind direction (σ_θ) data were collected at both levels. Hourly average temperature and relative humidity data were collected at the 10-meter level. Precipitation, pan evaporation, and the aerosol scattering coefficient (B-scat) data were also collected at the site. Hourly B-scat values were used to calculate visual ranges. Currently, a 10-meter tower is being used to collect meteorological data at the monitoring station.

The data collected on site during the 1981-1982 monitoring period are compared to available long-term data from Elko, Nevada in the following sections to provide a representative description of the meteorology and climate in the vicinity of the proposed power plant.

Additional meteorological data in the project region are available from Remote Automatic Weather Stations (RAWS) operated by the Bureau of Land Management (BLM). Data from two of these stations, Red Point (17 miles northwest of the project site) and Spruce Mountain (63 miles south-southwest of the project site), are also provided. RAWS data are presented for the period from September 1986 through December 1988. The locations of the Red Point and Spruce Mountains RAWS are shown on Figure 4.1-1.

4.1.2.2 Temperature/Humidity

The annual average temperature measured at the proposed TSPP site over the 1981-1982 time period was 46°F. A large seasonal temperature variation is evidenced by comparing the highest mean monthly temperature of 72°F during July 1981 to the lowest mean monthly temperature of approximately 24°F during January 1982.

In Elko, located about 70 miles west of the proposed TSPP site, the annual average temperature is approximately 46°F, based on a 30-year period of record. The annual average daily maximum temperature is 62°F, and the annual average daily minimum temperature is 30°F (U.S. Department of

Commerce [USDC] 1987). The seasonal temperature difference at Elko is similar to that observed at the TSPP site, as indicated by mean temperatures of 70°F in July and 24°F in January.

At the Red Point RAWS site, the annual average temperature is approximately 46°F, based on the 1986-1988 data. The annual average daily maximum temperature is 58°F, and the annual average daily minimum temperature is 33°F, resulting in an average diurnal variation of 25°F. At the Spruce Mountain RAWS site, the annual average temperature is approximately 47°F, also based on 1986-1988 data. The annual average daily maximum temperature is 59°F, and the annual average daily minimum temperature is 34°F, resulting in an average diurnal variation of 25°F. Average monthly diurnal temperature variations range from 20°F during winter to 31°F in summer at Red Point, and from 20°F during winter to 29°F in summer at Spruce Mountain.

Due to the semi-arid conditions in the vicinity of the proposed power plant site, relative humidity is generally low. Highest values occur during the evening and early morning hours when strong radiational cooling enables temperature to approach the dew point. High relative humidity also occurs during the cold winter months. The lowest mean monthly relative humidity at Elko is approximately 30 percent, while on site, the lowest mean monthly relative humidity was recorded at only 20 percent. Minimum and maximum hourly relative humidity ranged from 2 to 95 percent during the 1981-82 monitoring year at the on-site meteorological station.

At the Red Point and Spruce Mountain RAWS stations, the lowest mean monthly relative humidity was 27 percent and 28 percent, respectively. During the winter months, humidity increased to a mean monthly maximum of 71 percent at Red Point, and 66 percent at Spruce Mountain.

4.1.2.3 Precipitation

Annual precipitation totals are quite low in the vicinity of the proposed TSPP site due to the presence of the Sierra Nevada mountains and numerous smaller mountain ranges to the west. These mountains effectively block much of the westerly flow of moisture from the Pacific Ocean. Based on a climatological averaging period of 30 years, 1957-1986, Elko receives an annual average precipitation total of 9.30 inches. The year-to-year variation in annual precipitation is large at Elko, ranging from under 5 inches in 1974 to over 18 inches in 1983 (USDC 1987). Only 5.01 inches of precipitation were received at the on-site meteorological station for the monitoring year of 1981-1982. Annual average precipitation at the Red Point and Spruce Mountain RAWS for the 1986-1988 period were 4.6 and 4.8 inches, respectively.

Northwest of the TSPP site are the more mountainous regions of the Jarbidge Wilderness Area, where, based on 25 years of precipitation data, annual average precipitation at Pole Creek is 24.5 inches (U.S. Department of Agriculture [USDA] - Soil Conservation Service [SCS] 1989). This annual average precipitation in Jarbidge Wilderness Area indicates, as

might be expected, that precipitation is enhanced with increased elevation. Elevations in Jarbidge Wilderness Area range from about 7,000 to 11,000 feet.

4.1.2.4 Wind

During 1981-1982, on-site winds were measured at the TSPP site at the 10-meter (33-foot) and 100-meter (330-foot) levels. Winds at the 100-meter level were typically from the south/south-southwest and the west/west-southwest, while the winds at the 10-meter level were from the south/south-southeast and the west/west-southwest. The west/west-southwest windflow is indicative of the prevailing westerly flow. The second wind direction maximum is indicative of local terrain influences consisting of broad valleys bordered by mountain ranges oriented predominantly north and south. The greater occurrence and slight shift in southerly component winds at the 10-meter level may be attributable to a greater effect of local terrain features (i.e., the Windermere Hills and Ninemile Mountain) on lower level winds. Prevailing monthly wind directions for Elko are from the southwest (USDC 1987). This shift in wind direction from the TSPP site to Elko may be attributable to the influence of the nearby Humboldt Range, oriented northeast-southwest, on windflow patterns near Elko.

The average annual windspeed is 6.0 miles per hour (mph) at Elko, while on site, annual average windspeeds at the 10- and 100-meter levels were measured at 7.6 and 11.0 mph, respectively, excluding calms. At the Red Point and Spruce Mountain stations, annual average windspeeds are 9 and 8 mph, respectively. Windspeeds are generally low at both Elko and the TSPP site.

Figures 4.1-3 through 4.1-6 display surface wind roses in the western U.S. for January, April, July, and October, respectively. These months were selected as being representative of the winter, spring, summer, and fall seasons, respectively. Wind roses describe surface winds (not including calms) with the length of each radial representing the percent of time the surface wind blew from each of the compass directions. All of the wind roses with the exception of Ely, Winnemucca, and the TSPP site are based on hourly observations for the years 1951 to 1960 at National Weather Service stations. The wind rose for Winnemucca is based on hourly data from 1965 to 1972, Ely from 1967 to 1972, and the TSPP site from 1981 and 1982. Local surface winds can be quite complex since they can act individually, combine with each other, or be masked by the large scale synoptic winds. Because of localized or regional geographic influences, surface windspeeds and directions typically are not comparable to the larger scale synoptic winds.

During high pressure patterns, winds tend to be weak, and the driving mechanisms for air movement can be locally induced by terrain and diurnal temperature differences. Several examples of local influences can be seen on Figures 4.1-3 through 4.1-6. Winds in Salt Lake City are characterized by a southwest prevailing wind direction, primarily due to the north-south orientation of the Wasatch Mountain Range and a southerly drainage flow at

night. The prevailing northeast direction at the Pocatello, Idaho station is influenced by the Snake River Plain oriented in a northeast-southwest direction. Winds in Winnemucca, Nevada show a prevailing southerly direction due to the valley's north-south orientation and drainage flow down the valley at night. At the TSPP site, surface winds are predominantly from the south-southeast and a west/west-southwest direction. The latter is indicative of the prevailing synoptic flow, while the former is largely due to the local terrain influences of the north-south oriented Humboldt and Goshute mountain ranges.

Figures 4.1-7 through 4.1-10 show afternoon mixed-layer mean resultant windfields for January, April, July, and October. Figure 4.1-11 shows the annual average mixed-layer winds. These windfields depict the mid-level synoptic scale wind circulation. The windfields represent the average wind direction and windspeed of the mixed layer, which can extend upwards to approximately 1500 meters above ground level during summertime conditions. The mixed layer is considered the depth from the ground surface to the height where surface-induced turbulence (both mechanical and thermal) diminishes to the point where thorough mixing of the surface air no longer occurs. These windfields were developed as part of a study on regional haze in the southwest (American Petroleum Institute [API] 1985) using upper-air transport winds derived from the National Weather Service's Limited Fine Mesh Model (LFM), which calculates relatively high spatial resolution upper-air winds from twice-daily wind measurements. The LFM model is a sophisticated three-dimensional dynamic wind model that accounts for large terrain features.

The windfields shown on Figures 4.1-7 through 4.1-11 are vector averages of instantaneous wind measurements for the mixing depth only, as this is where dipsersion would occur. Further, the winds shown in these figures have been averaged over a much longer time period (e.g., month or year) to show the pattern typical of the seasons and year. However, they do not show the short-term hourly or daily variations in winds.

With the exception of the winter months, the seasonal variation of wind pattern over the western U.S. does not substantially change much with respect to the annual windfield on Figure 4.1-11. During the winter months, a transient surface high pressure system is situated over northwestern Arizona and southern Nevada, creating a clockwise air circulation. Figure 4.1-11 shows the strong influence of the Pacific high, indicative of the on-shore flow over California. Also, the winds due to the surface high over southern Arizona, and the strong westerlies in Nevada are a predominant feature throughout the year. Middle and upper level winds are typically strongest during the winter months.

4.1.2.5 Severe Weather

The occurrence of severe weather conditions in the vicinity of the TSPP site is infrequent and of short duration. During the period from 1955 to 1967, only eight tornadoes were reported in the entire state of Nevada (Thom 1968). From Elko climatological data, the average number of days per year

LEGEND

Source: Climate Atlas of the United States, 1968

20 15 10 5

Wind roses show percentage of time wind blew from the 16 compass points

Figure 4.1-3. JANUARY SURFACE WIND ROSES BASED ON HOURLY OBSERVATIONS FROM NATIONAL WEATHER SERVICE STATIONS

LEGEND

Source: Climate Atlas of the United States, 1968

20 15 10 5

Wind roses show percentage of time wind blew from the 16 compass points

Figure 4.1-4. APRIL SURFACE WIND ROSES BASED ON HOURLY OBSERVATIONS FROM NATIONAL WEATHER SERVICE STATIONS

LEGEND

Source: Climate Atlas of the United States, 1968

20 15 10 5

Wind roses show percentage of time wind blew from the 16 compass points

Figure 4.1-5. JULY SURFACE WIND ROSES BASED ON HOURLY OBSERVATIONS FROM NATIONAL WEATHER SERVICE STATIONS

LEGEND

Source: Climate Atlas of the United States, 1968

20 15 10 5

Wind roses show percentage of time wind blew from the 16 compass points

Figure 4.1-6. OCTOBER SURFACE WIND ROSES BASED ON HOURLY OBSERVATIONS FROM NATIONAL WEATHER SERVICE STATIONS

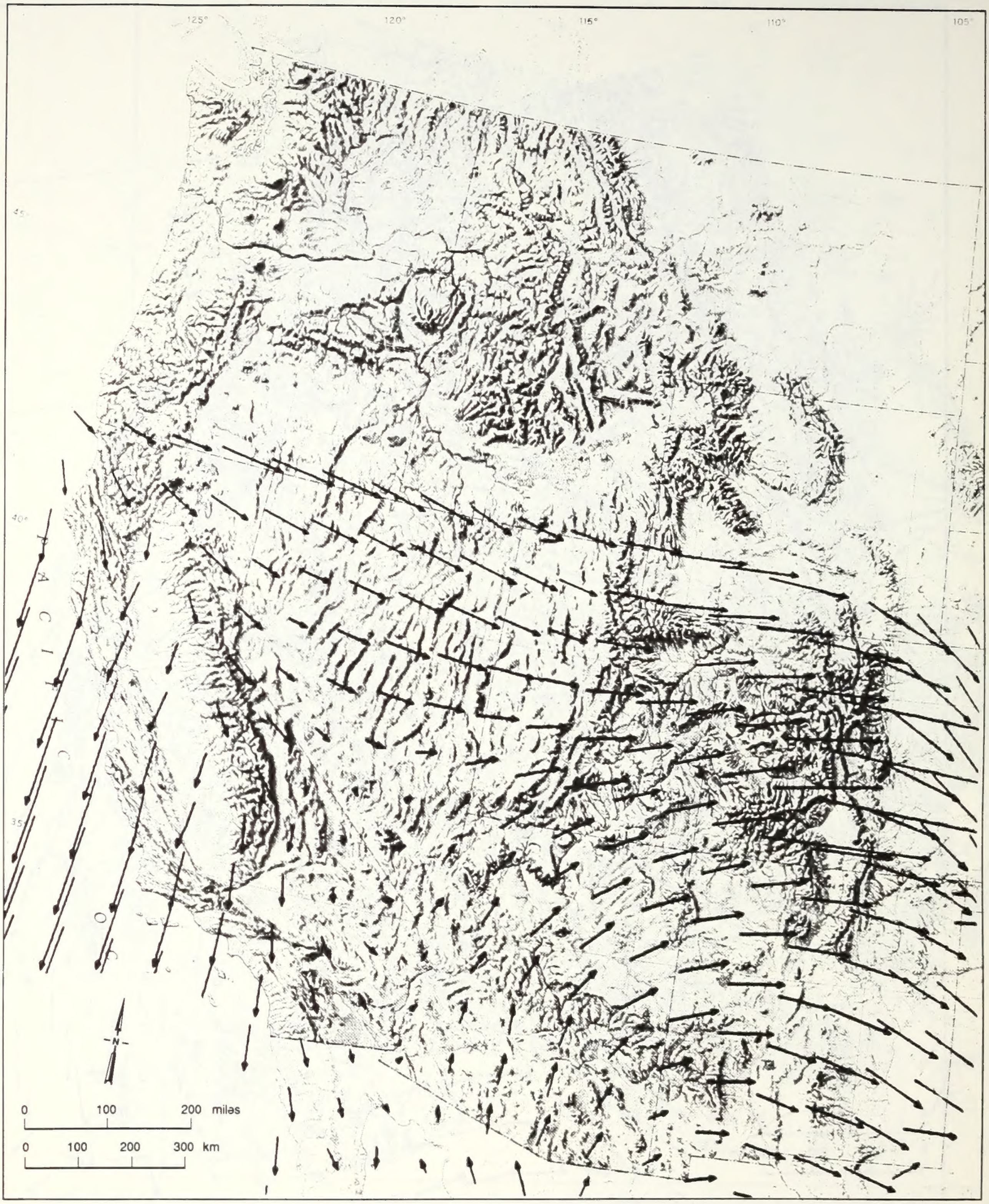
Source: API 1985

LEGEND

0 5
meter/sec

Wind direction denoted by arrow.
Wind speed (m/sec) denoted by length of arrow.

Figure 4.1-7. JANUARY AFTERNOON MIXED-LAYER MEAN RESULTANT LFM WIND FIELD IN 1981



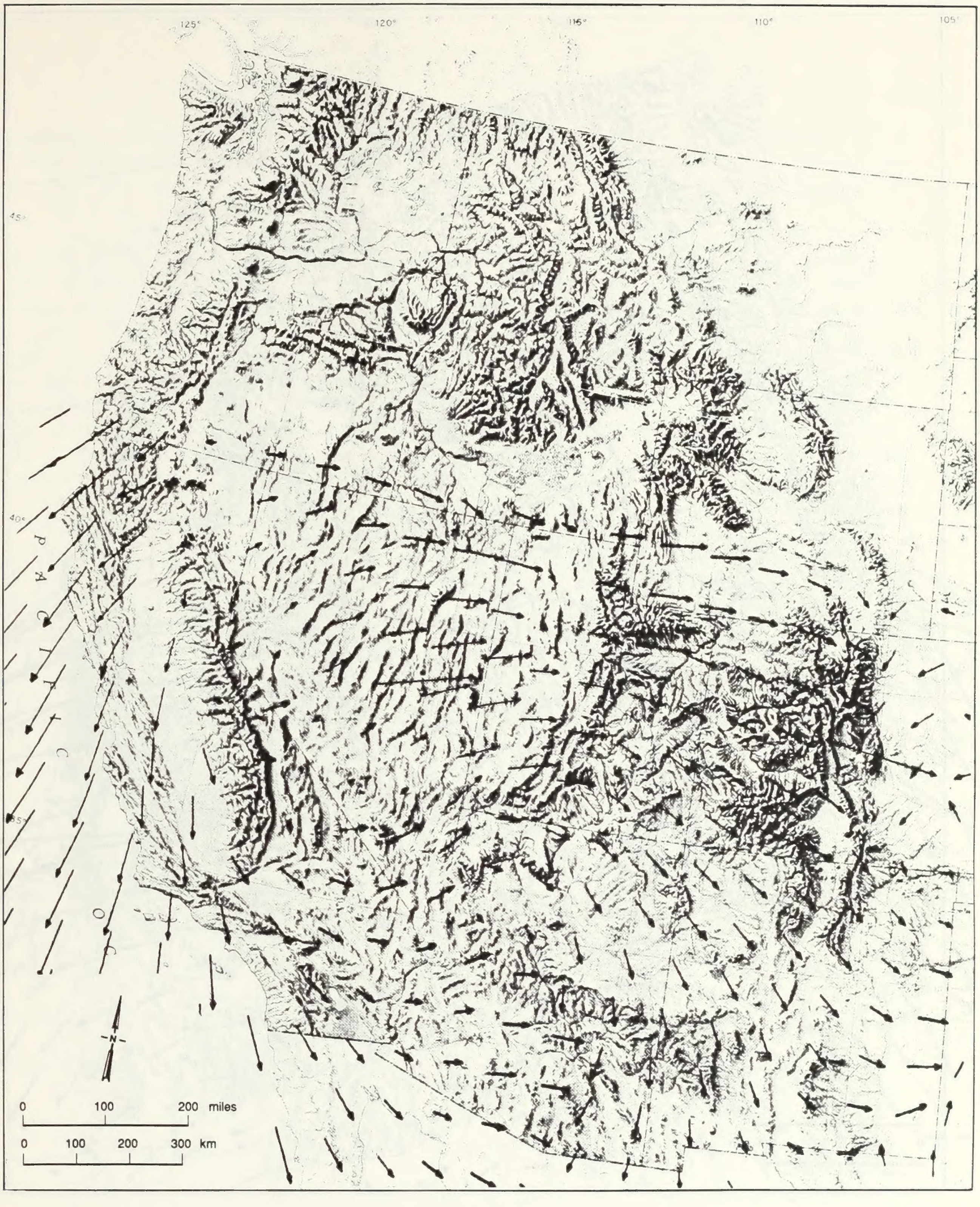
LEGEND

Source: API 1985

0 5
meter/sec

Wind direction denoted by arrow.
Wind speed (m/sec) denoted by length of arrow.

Figure 4.1-8. APRIL AFTERNOON MIXED-LAYER MEAN RESULTANT LFM WIND FIELD IN 1981



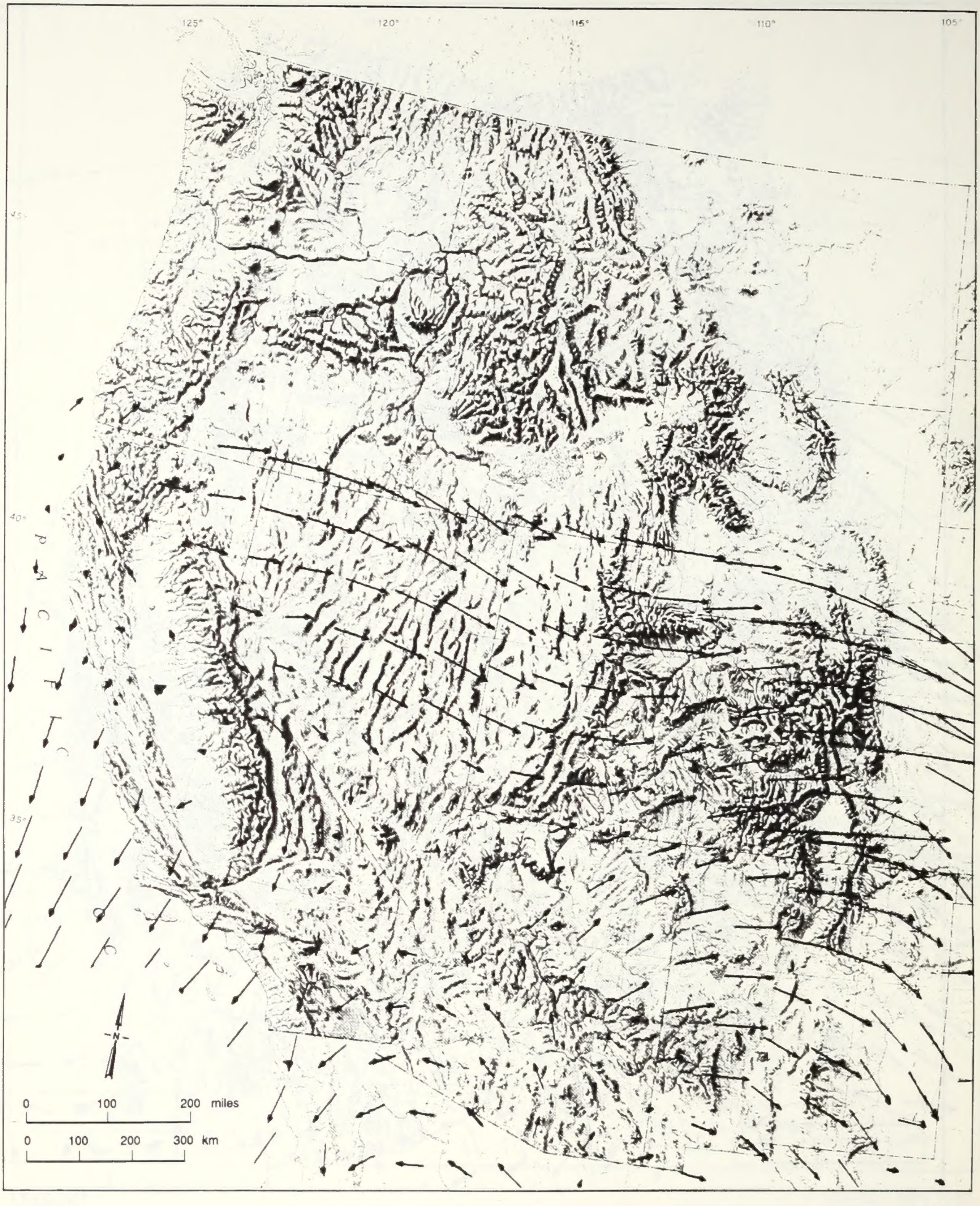
Source: API 1985

LEGEND

0 5
meter/sec

Wind direction denoted by arrow.
Wind speed (m/sec) denoted by length of arrow.

Figure 4.1-9. JULY AFTERNOON MIXED-LAYER MEAN RESULTANT LFM WIND FIELD IN 1981



Source: API 1985

LEGEND

0 5
meter/sec

Wind direction denoted by arrow.
Wind speed (m/sec) denoted by length of arrow.

Figure 4.1-10. OCTOBER AFTERNOON MIXED-LAYER MEAN RESULTANT LFM WIND FIELD IN 1981

LEGEND

Source: API 1985

0 5
meter/sec

Wind direction denoted by arrow.
Wind speed (m/sec) denoted by length of arrow.

Figure 4.1-11. ANNUAL AFTERNOON MIXED-LAYER MEAN RESULTANT LFM WIND FIELD IN 1981

with thunderstorms is less than 21, occurring primarily during the warmer months of May through September. Occasionally, "dust devils" may form during mid-summer afternoons in the presence of strong daytime heating.

The average number of days per year with snowfalls of 1-inch accumulation or more is 14. Average total snowfall for the year is 38.2 inches. The number of months at Elko in which total monthly snowfall exceeded 20 inches was 3 during the climatological period of 1957-86.

4.1.2.6 Dispersion Climatology

The ability of the atmosphere to disperse air pollutants is a function of several parameters, such as windspeed and direction, atmospheric stability, and mixing height. Stability is usually expressed in terms of Pasquill-Gifford categories, ranging from Class A (very unstable) to Class F (very stable) and is a measure of the degree of atmospheric turbulence. Based on measurements taken at the project site during the 1981-1982 monitoring period, good dispersion conditions (Classes A through D) occurred 63 percent of the time. Poor dispersion conditions (Classes E and F) occurred 37 percent of the time.

Mixing height provides an indication of the potential vertical extent of pollutant diffusion. It is a measure of the thickness of the layer of the lower atmosphere in which pollutants may freely disperse. As is typical of desert-like environments, the mixing-height in the project area can be quite high during the afternoon due to strong convective activity which mixes the air vertically throughout the lower levels of the atmosphere. Conversely, mixing heights can be quite low in the morning because of nighttime radiational cooling, which causes surface-based or low-level inversions to form. The annual average morning mixing height during the 1981-1982 period at Elko was approximately 200 meters (700 feet) and the annual average afternoon mixing height was approximately 2300 meters (7500 feet).

The mixing height is often determined by the occurrence of an inversion. Inversions occur when air temperature increases with height through a layer of the atmosphere. Inversions inhibit dispersion of pollutants. On an annual basis, the frequency of occurrence of all types of inversions was 61 percent at Ely. Low-level inversions, defined as inversions with their base between ground level and 100 meters above ground level, occurred 50 percent of the time. Shallow low-level inversions, defined as being ground-based inversions and with their ceilings at or below 100 meters above ground level, occurred 5 percent of the time on an annual basis and 11 percent of the time during the winter. The data show that the greatest majority of inversions occur at night, or during the pre-dawn hours.

Although inversions can occur as a result of a variety of different atmospheric and meteorological conditions, the majority of the inversions that occur in the project area are a result of nighttime radiative cooling of the earth's surface and associated cooling in the lower layer of the

atmosphere. Ideal conditions for radiative cooling, clear calm nights with low humidity levels, can occur frequently in the project area.

4.1.3 EXISTING CONDITIONS

4.1.3.1 Existing Ambient Air Quality

Air quality in the project region is generally good. The major contributor to air pollution is particulate matter resulting from wind-blown dust, especially from disturbed areas and from forest fires, either natural or man-caused, and controlled burning. Air quality is governed by two major factors, pollutant emissions and meteorological conditions. Meteorological factors such as windspeed, atmospheric stability, and mixing depth all affect the dilution rate of emitted pollutants, while solar radiation affects photochemical oxidant production. Frequent short-term variations in air quality usually result from changes in atmospheric conditions. Long-term variations typically result from changes in pollutant emissions.

The area within a 100-km radius of the proposed site includes Federal Air Quality Control Region areas that have been designated as "attainment" (Better than National Standards or Can Not be Classified) of Federal national ambient air quality standards (NAAQS) for all criteria pollutants (ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen dioxide, and lead). The nearest nonattainment (nonattainment for sulfur dioxide) area is in the southern portion of the Steptoe Valley), located more than 100 km south of the project site. With respect to fine particulate matter (i.e., particulate matter smaller than 10 μm, or "PM_{10}"), the area is classified by the EPA as "Group III", which means the area has less than a 20 percent chance of exceeding the Federal PM_{10} standards. In addition, the area is currently in attainment of all applicable Nevada air quality standards.

Air quality was monitored at the proposed project site over the period June 15, 1981 through June 14, 1982 (WCC 1982a). The pollutants included in the monitoring program were:

- Sulfur dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Total Suspended Particulate (TSP)
- Particulate Matter less than 15 micrometers in diameter (PM_{15})
- Ozone (O_3)
- Lead (Pb)
- Arsenic (As)
- Fluoride (F)

Lead and arsenic were measured on both the TSP and PM_{15} samples. PM_{10} was not monitored during this period since the standards for PM_{10} were not in existence at that time. During the period September 6, 1988 through September 25, 1989, PM_{10} and TSP data have been monitored. Table 4.1-4 summarizes the maximum ambient air pollutant concentrations monitored at

Table 4.1-4. SUMMARY OF MAXIMUM AMBIENT AIR POLLUTANT CONCENTRATIONS AT TSPP SITE

Pollutant/ Averaging Time	Concentration	National and State Standards
SO_2		
3-hour[a]	44 $\mu g/m^3$	1300 $\mu g/m^3$
24-hour	13 $\mu g/m^3$	365 $\mu g/m^3$
Annual	3 $\mu g/m^3$	80 $\mu g/m^3$
NO_2		
1-hour	10 $\mu g/m^3$	--
Annual	2 $\mu g/m^3$	100 $\mu g/m^3$
O_3		
1-hour	123 $\mu g/m^3$	235 $\mu g/m^3$
TSP		
24-hour[a]	44.7 $\mu g/m^3$	150 $\mu g/m^3$
Annual[a]	16.6 $\mu g/m^3$	75 $\mu g/m^3$
PM_{10}		
24-hour[b]	20.1 $\mu g/m^3$	150 $\mu g/m^3$ (PM_{10})
Annual[b]	8.4 $\mu g/m^3$	50 $\mu g/m^3$ (PM_{10})
Pb[c]		
24-hour	0.11 $\mu g/m^3$	--
Quarter	<0.05 $\mu g/m^3$	1.5 $\mu g/m^3$
Pb_{15}[c]		
24-hour	0.10 $\mu g/m^3$	--
Quarter	<0.05 $\mu g/m^3$	--
As		
24-hour	0.19 $\mu g/m^3$	--
As_{15}		
24-hour	0.13 $\mu g/m^3$	--

Table 4.1-4. SUMMARY OF MAXIMUM AMBIENT AIR POLLUTANT CONCENTRATIONS AT TSPP SITE (concluded)

Pollutant/ Averaging Time	Concentration	National and State Standards
F (Particulate)		
24-hour	0.26 μg/m^3	--
F (Gas)		
24-hour	0.36 μg/m^3	--

[a] State standard only.

[b] National standard only.

[c] Pb and As were measured on TSP samples while Pb_{15} and As_{15} were measured on PM_{15} samples.

Note: All pollutant concentrations listed, with the exception of TSP and PM_{10}, are from the June 15, 1981 to June 14, 1982 monitoring period. TSP and PM_{10} data were collected during the September 9, 1988 to September 25, 1989 monitoring period.

the proposed TSPP site. All pollutant concentrations listed in Table 4.1-4 except for TSP and PM_{10} are from data collected during the 1981-1982 monitoring period. TSP and PM_{10} data are from the 1988-1989 monitoring period. The monitored ambient concentrations are well below the ambient air quality standards. The ambient air quality has not degraded since the 1981-1982 monitoring program, as no new sources have been permitted in the area.

The monitored ambient concentrations, listed in Table 4.1-4 were used as representative background air quality and added to predicted impacts from the proposed power plant to obtain total ambient air pollutant concentrations. The total concentration for each pollutant will be compared to applicable ambient air quality standards for demonstration of compliance.

4.1.3.2 Applicable Regulations

The TSPP project must comply with all Federal, State, and local laws and regulations including the Clean Air Act, the Wilderness Act, and Federal Land Policy and Management Act. The Wilderness Act and Federal Land Policy and Management Act include provisions for protection of wilderness areas. The Clean Air Act, administered by the EPA, is designed to protect the public health and welfare, which includes specifically designated national wilderness areas.

Under the Clean Air Act, NAAQS have been promulgated to meet the goals of the Clean Air Act (i.e., protection of the public health and welfare). The NAAQS are listed in Table 4.1-5. The State of Nevada Division of Environmental Protection (NDEP) has adopted ambient air quality standards that are as stringent or more stringent than the NAAQS, as shown in Table 4.1-5.

Existing air quality in all areas potentially affected by the proposed project is currently better than national and state air quality standards. That is, these areas are in "attainment" of the ambient standards. Two major Federal programs established by the Clean Air Act for proposed new sources of air pollution in "attainment areas" are New Source Performance Standards (NSPS) and the PSD.

New Source Performance Standards. NSPS are emission limitations that apply to specific types of proposed new pollutant emitting equipment. For electric utility steam generators, NSPS for criteria air pollutants are as follows:

- Sulfur dioxide - 1.2 pounds per million Btu and a minimum reduction of 90 percent of the potential combustion concentration; or 0.6 pounds per million Btu and a minimum reduction of 70 percent of the potential combustion concentration.

- Oxides of nitrogen - 0.6 pounds per million Btu for bituminous coals, 0.5 pounds per million Btu for subbituminous coals, and a

Table 4.1-5. AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENTS ($\mu g/m^3$)

Pollutant and Averaging Time	NAAQS Primary	NAAQS Secondary	Nevada Ambient Air Quality Standards	Class I PSD Increments[c]	Class II PSD Increments[c]
SO_2					
3-hour[a]	--	1300	1300	25	512
24-hour[a]	365	365	365	5	91
Annual Arithmetic	80	80	80	2	20
PM[b]					
24-hour[a]	150	150	150	10	37
Annual Geometric	50	50	75	5	19
NO_2					
Annual Arithmetic	100	100	100	2.5	25
CO					
1-hour[a]	40,000	40,000	40,000	--	--
8-hour[a]: < 5000' MSL	10,000	10,000	10,000	--	--
≥ 5000' MSL	10,000	10,000	6,670	--	--
O_3					
1-hour[a]	235	235	235	--	--
Pb					
Quarterly Arithmetic	1.5	1.5	1.5	--	--
Hydrogen Sulfide					
1-hour[a]	--	--	112	--	--

[a] Short-term national standards and national and Nevada PSD increments (24 hours or less) are not to be exceeded more than once per year, at any location. Short-term Nevada standards are not to be exceeded at any time.

[b] National PM standards apply to particles less than 10 μm in diameter (PM_{10}), Nevada PM standards apply to all TSP, and national and Nevada PM PSD increments apply to TSP.

[c] PSD increments are exceeded if air quality impacts from all PSD sources in the area exceed these levels. PSD sources include all sources in the area for which a PSD permit is applied on or after the PSD baseline date. The baseline date is set by the first major source or major modification to apply for a PSD permit after August 7, 1977.

minimum reduction of 65 percent of the potential combustion concentration.

- Particulate matter - 0.03 pounds per million Btu and a minimum reduction of 99 percent of the potential combustion concentration.

- Opacity - Less than 20 percent (6-minute average), except for one 6-minute period per hour of no more than 27 percent.

The NSPS regulations give minimum percent reduction requirements in terms of "potential combustion concentration." For SO_2, the "potential combustion concentration" is taken to be the SO_2 concentration in the combustion gases prior to the application of any sulfur removal or gas cleaning technology. Therefore, the minimum percent reduction for SO_2 given in the NSPS can be compared directly with the proposed SO_2 removal efficiency for the TSPP stack gases. For oxides of nitrogen (NO_x) the "potential combustion concentration" is defined in the NSPS regulations for solid fuel (coal) as 2.30 pounds per million Btu. A minimum 65 percent reduction of this value would calculate to 0.80 pounds per million Btu. This limitation is higher than the specific NO_x emission limits given above for bituminous and subbituminous coals, thus the specific NSPS NO_x emission limits are more stringent for the proposed project than the minimum percent reduction in potential combustion concentration. Finally, for particulate matter, the NSPS regulations define the "potential combustion concentration" for solid fuel as 7.0 pounds per million Btu, therefore a 99 percent reduction of this value would give 0.07 pounds per million Btu. Thus, the 0.03 pound per million Btu emission limit for particulate matter given above would apply to the proposed TSPP since it is more stringent. With respect to other criteria and noncriteria air pollutants, there are no applicable NSPS emission limitations.

<u>Prevention of Significant Deterioration</u>. In addition to the requirement to achieve minimum NAAQS, the Clean Air Act outlines a special program for major sources proposing to locate in areas where existing air quality is better than applicable air quality standards. This program is called PSD. The goal of the PSD regulations is to keep clean air relatively clean by limiting the amount of allowable air quality degradation in areas currently in attainment of the ambient standards. The regulations contain cumulative increment limits for ambient concentrations of SO_2, NO_2, and TSP that are allowed over existing "baseline" concentrations. As new major sources of air pollution propose to locate in an "attainment" or "unclassified" area, each new source "consumes" portions of the allowable increment. For each pollutant, overall air quality degradation is limited to the amount of the remaining increment in the area or to the applicable ambient air quality standard, whichever is most restrictive. In Nevada, the authority to implement Federal PSD regulations has been delegated by the EPA to the NDEP.

Available air quality increments are location specific and, therefore, vary throughout the area where a major source (PSD source) is proposed to

be located. At any given location, the available increment depends on the amount consumed by a particular source. Multiple major sources can reside in the same general area as long as the cumulative concentration impacts at every location are below the increments and the ambient air quality standards are not violated. Increment consumption by multiple sources in a region is usually determined through air quality dispersion modeling.

Air pollution sources subject to PSD are required to include certain supporting analyses in their air pollution control permit applications. The key PSD analyses include: documentation that the proposed air pollution control systems constitute the "best available control technology" (BACT); an air quality impact analysis demonstrating that the ambient air quality standards and allowable air quality increments will not be exceeded; and a demonstration that the proposed source will not have an adverse impact on AQRVs in Class I areas (some designated national parks and national wilderness areas). Each of these are summarized briefly below.

Best Available Control Technology. A PSD permit application must include documentation that the proposed emission control system represents BACT. The Clean Air Act denotes BACT as an emission limitation based on the maximum degree of reduction with respect to each pollutant, taking into account energy, environmental, and economic impacts, as well as other costs. BACT is required for each pollutant regulated under the Clean Air Act that exceeds certain threshold emission levels. Control technology requirements that fulfill BACT are determined on a case-by-case basis. However, the BACT applied to a source must always control pollutant emissions to levels that are at least as stringent as NSPS.

As summarized in Section 3.2.3.6, an evaluation of alternative control technologies was performed for the proposed TSPP project. This analysis, however, is not intended to be a complete BACT analysis. Such an analysis will be submitted with the proposed project's PSD permit application to the NDEP, and the authority to establish final BACT emission limitations is with the NDEP. The proposed emission limitations presented in this EIS are the applicant's best current assessment of BACT for the proposed project.

Because the TSPP project consists of eight individual construction phases that would take place over a period of approximately twenty years, it would be considered a "phased construction" project with respect to PSD regulations. The PSD regulations require that the determination of BACT be reviewed prior to implementation of each independent construction phase. Specifically, under PSD regulations [40 CFR 52.21 (j) (4)], the following would apply to the proposed TSPP project:

> For phased construction projects, the determination of best available control technology shall be reviewed and modified as appropriate at the latest reasonable time which occurs no later than 18 months prior to commencement of construction of each independent phase

of the project. At such time, the owner or operator of the applicable stationary source may be required to demonstrate the adequacy of any previous determination of best available control technology for the source.

Air Quality Impact Analysis. The PSD applicant must submit an air pollution dispersion modeling analysis demonstrating that the proposed source would not cause or contribute to a violation of any applicable ambient air quality standard or any allowable air quality increment. The ambient air quality standards analysis is a general indicator of significance for any project, since ambient air quality standards are designed to protect the public health with an adequate margin of safety. The air quality increments analysis is an indicator of significance particular to the proposed PSD source, where the focus is protecting the quality of the existing clean air. In attainment areas, the applicable air quality increments depend on the classification of the area. All attainment areas can be designated into one of three classifications:

- Class I areas, where the most stringent degree of protection from future air quality degradation applies
- Class II areas, where a moderate degree of protection from future air quality degradation applies
- Class III areas, where a lesser degree of protection from future air quality degradation applies

At the present time, there are no areas in the U.S. designated as Class III. Current Class I areas include the following areas which were in existence at the time of the adoption of the Clean Air Act Amendments (August 7, 1977): international parks, national wilderness areas exceeding 5000 acres in size, national memorial parks exceeding 5000 acres in size, and national parks exceeding 6000 acres in size. All other attainment areas in the U.S. are currently designated as Class II. A listing of allowable Class I and Class II PSD air quality increments can be found in Table 4.1-5.

The air quality study area for the proposed TSPP is designated as Class II. In addition, there is one Class I area in the State of Nevada potentially affected by the proposed project, the Jarbidge Wilderness Area, approximately 75 km (47 miles) from the proposed project site.

Air Quality Related Values. The EPA regulations provide for additional protection of AQRVs in PSD Class I areas. The regulations allow a "Federal Land Manager" to recommend denial of a PSD permit application to the EPA Administrator or his designee if the proposed source can be shown to have an adverse impact on AQRVs. For the proposed project, the potentially affected Class I area is Jarbidge Wilderness Area, for which the Federal Land Manager is the USFS "Regional Forester," who supervises the Intermountain Region National Forests in Nevada, Utah, and parts of Idaho,

Wyoming, Colorado, and California. AQRVs identified by the USFS are discussed in Section 4.1.3.4.

Other Criteria Air Pollutant Requirements. In addition to PSD requirements, the proposed TSPP must comply with specific particulate matter and sulfur emission limitations contained in the Nevada Administrative Code (NAC).

Air Toxics. NAC 445.717 through 445.7205 contain criteria for evaluating emissions of toxic or hazardous air contaminants from stationary sources. An air contaminant is defined as toxic or hazardous under one of two conditions: it has been assigned a Threshold Limit Value (TLV) by the American Conference of Governmental Industrial Hygienists, based on its toxic properties in humans; or it has been determined by the Director of the Nevada State Department of Conservation and Natural Resources to cause or contribute to air pollution such that exposure may result in increased mortality or irreversible morbidity.

For the proposed TSPP, acceptable off-site air concentrations of toxic or hazardous contaminants must be established for ambient air. Acceptable concentrations for toxic or hazardous air contaminants for the quality of ambient air (ACQAA) are based on TLVs (or other toxic factors determined by the NDEP) divided by a safety factor. Compliance with ACQAAs must be demonstrated through ambient air monitoring and/or emission sampling and/or dispersion modeling techniques. A predicted or demonstrated exceedance of an ACQAA requires the application of the BACT for the applicable toxic or hazardous air contaminant to achieve compliance with the ACQAA.

4.1.3.3 Emission Inventory

Several air pollution source emission inventories were developed as part of the procedure for assessing potential impacts of the TSPP project, as well as for comparative purposes. These inventories are described below.

Major Source Inventory. According to the NDEP (NDEP 1989) there are no sources within 100 km of the proposed TSPP project site that emit more than 100 tons per year of any pollutant regulated under the Clean Air Act. Thus, there are no other "major sources" in the vicinity of the proposed project that would be subject to PSD requirements, or would have a significant impact in the region where the TSPP would locate. This means that none of the PSD increments for SO_2, NO_x, or particulate matter have been reserved for any other major sources.

While there are no major sources within 100 km of the TSPP site, there are other existing or proposed utility power plant sources in Nevada and western Utah where concerns over potential cumulative impacts have been expressed. These sources are listed in Table 4.1-6. Emissions from these sources were used in assessing cumulative impacts. The closest power plant to the proposed TSPP is the North Valmy Power Plant located near Winnemucca, about 140 miles (225 km) west-southwest of the TSPP site. In

Table 4.1-6. MAJOR SOURCE EMISSION INVENTORY (SO_2 AND NO_2) FOR PROPOSED AND PERMITTED POWER PLANTS IN NEVADA AND WESTERN UTAH

Source Name	Source Type	Location (County, State)	Capacity (MMBtu/hr)	Annual Emission Rate SO_2 (lb/hr)	Annual Emission Rate NO_2 (lb/hr)	Stack Height (m)	Stack Diam. (m)	Stack Temp. (K)	Stack Vel. (m/sec)
Clark	Boiler 1	Clark, NV	450	350.1	231.0	30.5	2.6	383	13.8
Clark	Boiler 2	Clark, NV	565	439.5	297.0	30.5	2.7	416	16.0
Clark	Boiler 3	Clark, NV	662	529.6	341.0	47.6	3.4	414	13.9
				1319.2	869.0				
Harry Allen	Boiler	Clark, NV	5676	564.4	2497.8	175.0	6.7	327	20.1*
Harry Allen	Boiler	Clark, NV	5676	564.4	2497.8	175.0	6.7	327	20.1*
Harry Allen	Boiler	Clark, NV	5676	564.4	2497.8	175.0	6.7	327	20.1*
Harry Allen	Boiler	Clark, NV	5676	564.4	2497.8	175.0	6.7	327	20.1*
				2257.5	9991.2				
Sunrise	Boiler	Clark, NV	790	612.9	363.8	41.2	3.7	401	11.5
Reid Gardner	Boiler 1	Clark, NV	1115	613.3	880.9	61.0	3.8	338	12.3
Reid Gardner	Boiler 2	Clark, NV	1115	613.3	1059.3	73.2	3.8	338	14.8
Reid Gardner	Boiler 3	Clark, NV	1237	680.3	618.5	82.3	3.8	338	12.7
Reid Gardner	Boiler 4	Clark, NV	2956	857.2	1773.6	152.0	6.1	338	10.9
				2764.1	4332.3				
Valmy	Aux. Boiler	Humboldt, NV	112	156.7	16.0	64.0	1.0	557	27.4
Valmy	Boiler 1	Humboldt, NV	2499	2998.8	1750.5	52.4	5.8	499	20.2
Valmy	Boiler 2	Humboldt, NV	2499	1499.1	1249.5	138.7	5.2	359	23.0
				4654.6	3016.0				
White Pine	Boiler 1	White Pine, NV		1490	4424.8	229.0	7.9	344	19.6
White Pine	Boiler 2	White Pine, NV		1490	4424.8	229.0	7.9	344	19.6
				2980	8849.6				
Intermountain	Boiler 1	Millard, UT	8352	1063.0	3905.0	216.0	12.9	350	21.0
Intermountain	Boiler 2	Millard, UT	8352	1063.0	3905.0	216.0	12.9	350	21.0
				2126.0	7810.0				

Source: NDEP 1989

* Stack velocity calculated from volumetric flow rate and stack cross-sectional area.

addition to the existing power plants, there are the proposed Harry Allen power plant, 25 miles northeast of Las Vegas; and the White Pine power plant in White Pine County. Of these two proposed power plants, only the Harry Allen plant currently has obtained a PSD permit and is included in the emission inventory, but has not yet been built. The White Pine power plant at one time had been issued a PSD permit. According to the NDEP, the White Pine power plant's PSD permit has expired, and therefore, the project must reapply for the permit prior to construction.

As part of the National Acid Precipitation Assessment Program (NAPAP) emissions inventories of SO_2 and NO_x in the U.S. have been compiled. Based on the 1985 NAPAP emission inventory (EPA 1988a), in the western U.S. about 2 million tons/yr of SO_2 and 3.3 million tons/yr of NO_x are emitted. Of that, Nevada contributes about 40,240 tons/yr of SO_2 and 112,672 tons/yr of NO_x. Table 4.1-7 lists estimated emissions of SO_2 and NO_x from both point and area sources for the western U.S., in addition to the total estimated U.S. emissions.

Minor Source Inventory. An emission inventory for SO_2, NO_x, and TSP was also developed for minor sources (those sources not requiring PSD permits) permitted by the NDEP within 100 km of the proposed project site and for permitted sources located near Elko. This emission inventory was used to assess both the short- and long-term air quality impacts from the interaction of these sources with the proposed TSPP. This inventory is provided in the Air Quality Technical Report.

4.1.3.4 Air Quality Related Values

The following AQRVs have been identified by the USFS as having value related to the quality of air (USFS 1987a):

- Flora
- Fauna
- Soil
- Water
- Odor
- Visibility
- Cultural and archaeological resources

As there is potential for the proposed project to impact these resources, it is important to establish their existing condition, so that potential changes resulting from the project may be evaluated. In its air resource management program for the Jarbidge Wilderness Area (USFS 1987b), the Forest Service has identified AQRVs, along with sensitive receptors, and has developed specific Limits of Acceptable Change (LACs) for Jarbidge. According to the USFS, "until there is sufficient baseline AQRV data to statistically define the air pollution effects found in the Jarbidge Class I area, the Federal Land Manager has defined the LACs for AQRVs to be a measurable change from the present condition." Thus, the LACs set for this Class I area are defined in terms of an incremental quantity above the current background pollution levels. Table 4.1-8 lists the AQRVs and LACs

Table 4.1-7. SULFUR DIOXIDE AND NITROGEN OXIDE EMISSIONS IN THE WESTERN U.S. BASED ON 1985 NAPAP EMISSION INVENTORY

State	SO_2 (tons) Point Sources	Area Sources	Total	NO_x (Tons) Point Sources	Area Sources	Total
Arizona	674,557	24,858	699,415	75,449	170,021	245,470
California	82,487	144,031	226,518	230,736	1,013,827	1,244,563
Colorado	76,322	15,111	91,433	133,034	158,808	291,842
Idaho	24,274	12,535	36,809	6,432	81,322	87,754
Montana	77,765	13,348	91,113	39,849	115,564	155,413
Nevada	34,216	6,024	40,240	62,427	50,245	112,672
New Mexico	249,620	21,808	271,428	184,159	100,688	284,847
Oregon	12,185	32,421	44,606	10,897	159,650	170,547
Utah	53,058	18,734	71,792	86,819	83,900	170,719
Washington	137,334	31,073	168,407	72,731	201,608	274,339
Wyoming	190,550	21,216	211,766	125,284	101,144	226,428
Total	1,612,368	341,159	1,953,527	1,027,817	2,236,777	3,264,594

Source: EPA 1988a

Table 4.1-8. AIR QUALITY RELATED VALUES AND LIMITS OF ACCEPTABLE CHANGE

Air Quality Related Value	Sensitive Receptor	Limit of Acceptable Change
Jarbidge Wilderness Area[a]		
Water	lake alkalinity	0.1 of a pH unit
Flora	lichens	5 kg/ha-yr of depositional sulfate
Visibility	visual range, fine particulates	5 percent visibility change
General FS Wilderness/AQRV[b] Management Guidelines		
Water	lake alkalinity	5 kg/ha-yr total depositional sulfur
Flora	lichens	5 kg/ha-yr total depositional sulfur
Fauna	macrobiotic aquatic insects	3-5 kg/ha-yr total nitrogen deposition
		35 ppb ozone (growing season average)
		75 ppb ozone (highest 1-hr average per year)
Visibility	visual range reduction, fine particulates	5 percent visual range decrease

Source: USFS 1987b
Source: USFS 1989a

To convert from sulfur to sulfate, multiply by 3.

To convert from nitrogen to nitrate, multiply by 4.4.

that have been defined for Jarbidge Wilderness Area. These LACs are used as indicators of impact significance in Jarbidge Wilderness Area.

In addition to the specific LACs for Jarbidge Wilderness Area, the USFS has general AQRV guidelines for the management of Class I areas (USFS 1989b) and has indicated other AQRVs and LACs that would be applicable when evaluating air quality impacts from the proposed TSPP project (USFS 1989a). These additional AQRV and LAC guidelines are also provided in Table 4.1-8.

LACs have not been set for wilderness areas located in PSD Class II areas. The Clean Air Act only specifies that AQRVs shall be protected in Class I areas. For wilderness areas located in Class II areas, the applicable criteria for determining impact significance are the national and state ambient air quality standards. Although LACs for Class I areas do not directly apply to Class II areas, they can be used for comparison purposes.

The following discussions focus on the existing visibility, precipitation chemistry, i.e., "acid rain," or more correctly, acid deposition of the region and how they relate to sensitive receptors.

Visibility. Due to very low ambient concentrations of fine particles and the dry nature of the area surrounding the proposed power plant site, visibility is extremely good. A common measure of visibility is the standard visual range, which is the distance from an observer at which a black object just disappears against the horizon. Visibility conditions are monitored by the National Park Service (NPS) and the Interagency Monitoring of Protected Visual Environments (IMPROVE) program at numerous locations throughout the country. Most of the visibility monitoring sites are Class I areas, which the Clean Air Act Amendments of 1977 singled out for special visibility protection. Some other sites were included in response to a particular visibility problem, because visual air quality was an especially important value at those parks, or because they were situated along an important pollution pathway (NPS 1988).

Figure 4.1-12 shows the median standard visual range for the western U.S. from June through August 1983. The median value means that 50 percent of the time the visual range is at this level or greater. Figure 4.1-12 indicates that the area with the best visibility in the U.S. is in Nevada, Utah, and Idaho, with a median summer visual range between 190 and 210 km.

At the proposed TSPP site, visual range information collected at the monitoring station can be used as an indicator of prevailing existing visibility. Visual ranges during the 1981-1982 on-site monitoring period varied from a minimum value of 16 km (10 miles) to a maximum of 224 km (139 miles). The geometric mean visual range for the 1-year period was computed as 142 km (88 miles). Additional details on visibility in the project region are detailed in the Air Quality Technical Report.

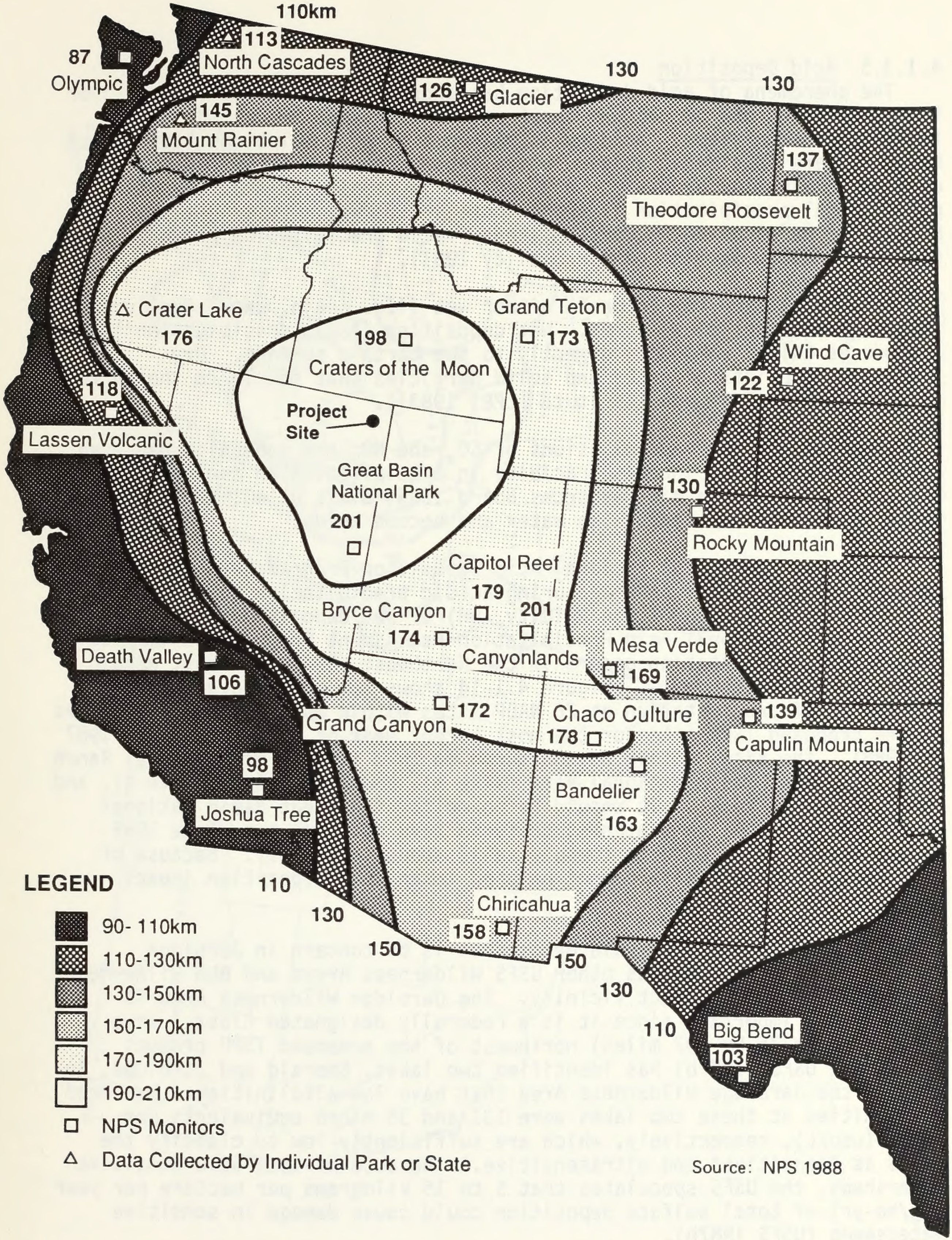


Figure 4.1-12. ISOPLETHS OF MEDIAN VISUAL RANGE OVER THE WESTERN UNITED STATES, SUMMER 1983

4.1.3.5 Acid Deposition

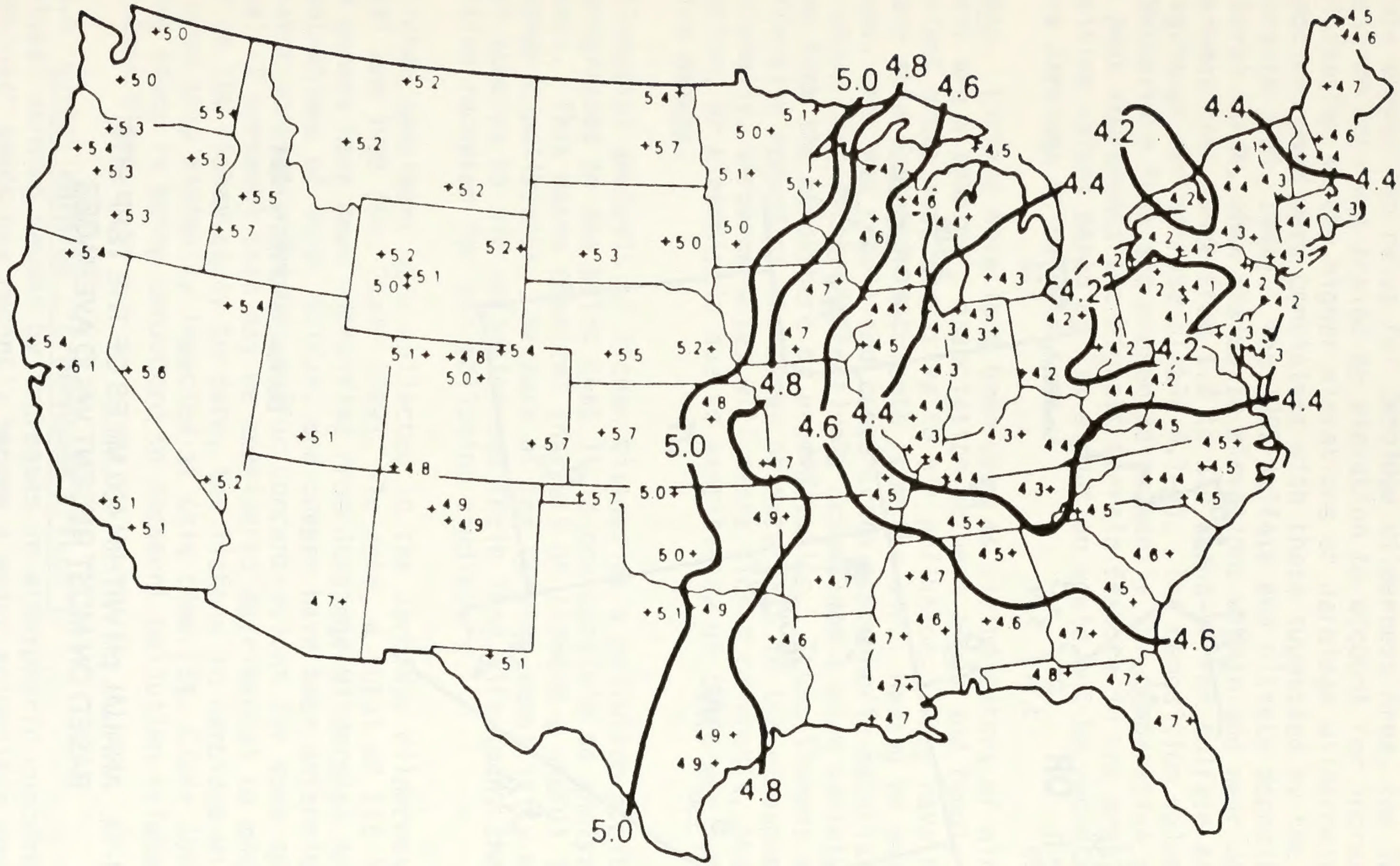
The phenomena of acid deposition has undergone considerable study over the past decade due to concern about potential damage to aquatic and terrestrial ecosystems. Acidity is measured by pH. Solutions having a pH below 7.0 are considered acidic, while those with a pH above 7.0 are considered alkaline or basic. A pH of 7.0 is considered neutral. The pH of normal precipitation is approximately 5.6, which is slightly acidic, but it can be alkaline in certain areas. Acid precipitation has a pH below 5.6 (National Commission on Air Quality 1981).

Acid deposition may occur in either wet (i.e., rain, snow, fog) or dry (i.e., gases, particles) forms. Wet deposition ("acid precipitation") introduces acidic compounds directly to the earth's surface. Dry deposition consists of gases and solid particles that settle to the surface (Electric Power Research Institute [EPRI 1983]).

Increases in man-made emissions of SO_x and NO_x are generally believed to be the reason for increased acidity in precipitation in many parts of the world (California Air Resources Board 1985; Glass et al. 1982), since these pollutants may react with water and become acids.

In recent years, the National Acid Deposition Program/National Trends Network (NADP/NTN) has been measuring acidic precipitation across the U.S. Figure 4.1-13 shows the acidity (pH) of wet deposition throughout the U.S. in 1987 (National Acid Precipitation Assessment Program 1989). The most acidic precipitation occurs in the Northeast while the least acidic occurs in the western U.S. Figure 4.1-14 shows the annual average values for the pH of precipitation at 26 NADP sites within approximately 400 miles of the proposed TSPP site for the most recent year of data (generally 1987 or 1988). The sites within Nevada shown on this figure include Saval Ranch (Site a), Great Basin National Park (Site b), Red Rock Canyon (Site c), and Smith Valley (Site d). It should be noted for the Great Basin National Park site, the NADP completeness criteria have not been met since 1985 (i.e., insufficient data to compute valid annual averages). Because of this, data from this site cannot be used in an acid deposition impact analysis.

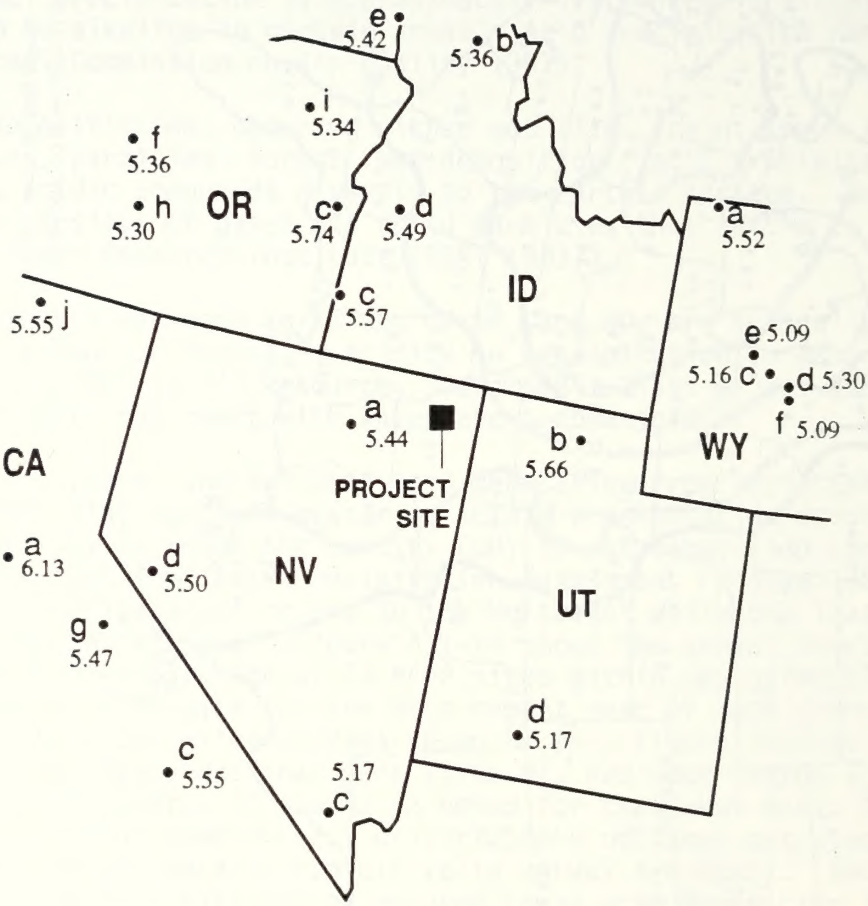
Potential increase of acid deposition is of concern in Jarbidge Wilderness Area, as well as other USFS Wilderness Areas and BLM Wilderness Study Areas in the project vicinity. The Jarbidge Wilderness Area is particularly important since it is a Federally designated Class I area located about 75 km (47 miles) northwest of the proposed TSPP project site. The USFS (1987b) has identified two lakes, Emerald and Jarbidge, in or near the Jarbidge Wilderness Area that have low alkalinities. Measured alkalinities at these two lakes were 131 and 35 micro equivalents per liter (μeq/L), respectively, which are sufficiently low to classify the lakes as "sensitive" and ultrasensitive." Because of such acid-sensitive watersheds, the USFS speculates that 5 to 15 kilograms per hectare per year (kg/ha-yr) of total sulfate deposition could cause damage in sensitive watersheds (USFS 1987b).



Note: Isolines omitted in western U.S. due to scarcity of data points.

Source: NAPAP 1989

Figure 4.1-13. pH WET DEPOSITION IN 1987 (PRECIPITATION-WEIGHTED ANNUAL AVERAGE) BASED ON NATIONAL ACID DEPOSITION PROGRAM / NATIONAL TRENDS NETWORK



Source: NADP/NTN 1989

Figure 4.1-14. ANNUAL pH WITHIN 400 MILES OF THE TSPP SITE BASED ON MOST RECENT VALID AVERAGES

Saval Ranch, located in Elko County, is the closest NADP monitoring site to the TSPP project. To obtain representative background sulfate and nitrate deposition rates for Jarbidge Wilderness Area, the Saval Ranch deposition data was scaled by elevation to account for increased precipitation at the higher elevations of Jarbidge Wilderness Area. Assumptions used were consistent with those suggested by the USFS (Galbraith 1984, 1986). The 1987 sulfate and nitrate deposition values for Saval Ranch, when scaled to elevations within and near Jarbidge Wilderness Area range from 1.8 to 3.4 kg/ha-yr for sulfate and from 2.1 to 4.0 kg/ha-yr for nitrate (Table 4.1-9). The deposition values projected for Matterhorn Peak are presented primarily for comparative purposes since this peak represents the highest terrain feature in the area, and deposition values based on its elevation would not be representative of the entire Jarbidge Wilderness Area.

Lichens. Lichens have long been used as bioindicators of air pollution. Lichens are a symbiotic association between algae and fungi. They may be the plant group most sensitive to air pollution. They have no root system and are able to obtain nutrients from the air. Having no excretion systems, they may retain and concentrate atmospheric materials. It has been shown that lichens effectively accumulate a wide variety of pollutants washed from the atmosphere by precipitation. Thus, lichens may provide an effective record of the types of materials in the atmosphere. Additionally, airborne acids will cause lichen chlorosis, phaeophytin formation, or plasmolysis due to sensitivity of the algae symbiont to thallus damage.

Elemental analysis of lichen tissues as a pollution monitoring device has progressed to the point that it is now possible to analyze specific elements. This makes chemical analysis of lichens a useful indicator of atmospheric pollutants. Because of the varying sensitivity of different lichen species to air pollution and their long life span, they are a useful sensitive receptor for air pollution studies.

Lichen specimens were collected in the Jarbidge Wilderness Area in July of 1987 and 1988 (St. Clair 1989). To date, a total of 115 lichen species in 44 genera have been identified from Jarbidge Wilderness Area. Thallus concentrations of lead, sulfur, and copper have been determined for indicator species. Thallus sulfur concentrations for some species are near a level (2 percent) that may be considered detrimental to most lichens. Based on the lichen study to date, the lichens in Jarbidge Wilderness Area have been only minimally impacted at this time (St. Clair 1989). An ongoing study is being conducted to document pollution-related changes in the lichen flora.

4.1.3.6 Global Warming ("Greenhouse Effect")

Global warming caused by increases in atmospheric concentrations of "greenhouse" gases has recently become a major scientific and political issue. Heat-trapping gases that are thought to contribute to the "greenhouse" effect include CO_2, methane, chlorofluorocarbons, NO_x,

Table 4.1-9. SAVAL RANCH WET DEPOSITION DATA SCALED TO ELEVATIONS REPRESENTATIVE OF THE JARBIDGE WILDERNESS AREA

Parameter	Saval Ranch 6,070 ft msl	SW Corner (min.) 7,120 ft msl	Emerald Lake 9,400 ft msl	Jarbidge Lake 9,330 ft msl	Matterhorn Peak (max.) 10,838 ft msl
Precipitation (inches)					
1986-1987	11.1	17.8	27.6	27.3	33.7
1987	11.8	17.8	27.6	27.3	33.7
pH					
1986-1987	5.49	5.49	5.49	5.49	5.49
1987	5.44	5.44	5.44	5.44	5.44
Sulfate Concentration (mg/l)					
1986-1987	0.37	0.37	0.37	0.37	0.37
1987	0.39	0.39	0.39	0.39	0.39
Nitrate Concentration (mg/l)					
1986-1987	0.45	0.45	0.45	0.45	0.45
1987	0.46	0.46	0.46	0.46	0.46
Sulfate Deposition (kg/ha/yr)					
1986-1987	1.1	1.8	2.7	2.7	3.4
1987	1.2	1.8	2.8	2.8	3.4
Nitrate Deposition (kg/ha/yr)					
1986-1987	1.3	2.1	3.2	3.2	4.0
1987	1.4	2.1	3.3	3.2	4.0

tropospheric (lower atmosphere) ozone, and several other trace gases (EPRI 1988). From 1880 to 1980, CO_2 comprised approximately 66 percent of the gases thought to influence global warming, but during the 1980s it dropped to 49 percent of the contribution (OTA 1988).

The earth's temperature represents a balance between incoming solar energy (light) and outgoing infrared radiation (heat). It is the absorption of some of the infrared radiation by atmospheric gases (water vapor and, to some extent, CO_2) which gives us our present global temperature. Any increases in the concentration of atmospheric gases that absorb the outgoing infrared radiation could result in a temperature rise. The concern over a temperature increase is commonly referred to as the "greenhouse" effect because the heat-trapping gases behave in a manner somewhat analagous to that of glass in a greenhouse, in that it allows solar energy to penetrate but keeps some heat from escaping (Perhac 1988). Estimates of present and future climatic changes have significant uncertainties.

Atmospheric levels of CO_2 have increased by about 25 percent since 1850 (Ramanathan et al. 1987) and may be partially attributable to fossil fuel combustion and deforestation. The other greenhouse gases have increased by even larger factors, but these gases make up a smaller proportion of the earth's atmosphere. In order to study potential climate changes that may result from the greenhouse effect, scenarios that show alternative future concentrations of CO_2 based on assumed growth rates in the use of fossil fuels have been developed (Lovins et al. 1981). The most typical projections of fossil fuel use are in the 0.5 to 2 percent annual growth range and imply that CO_2 concentrations may increase from an approximate current level of 350 to 600 ppm sometime between 2030 and 2080 (Schneider 1989). The record at Mauna Loa observatory in Hawaii shows that concentrations have increased from 310 to more than 350 ppm since 1958 (Nierenberg 1989). There is considerable uncertainty about how much newly introduced CO_2 will remain in the air during the next century, but typical estimates put this so called "airborne fraction" at about 50 percent (Schneider 1989).

The extent to which CO_2-induced climatic changes may prove significant in the future depends, of course, on the rate of injection of CO_2 and other greenhouse gasses into the atmosphere. This depends, in turn, on how much fossil fuel burning will take place. Climatic effects are further complicated by feedback mechanisms. For example, cloud cover changes in amount, height, or brightness can alter the climatic response to CO_2 (Clark 1982). Also, if increased CO_2 concentrations do cause a temperature increase, the warming would likely decrease land coverage of snow and ice, thereby decreasing the global albedo. The initial warming would, therefore, create a darker surface that would absorb more energy, thereby creating a larger final warming (Schlesinger and Mitchell 1987). Because feedback mechanisms interact in the climatic system, estimating global temperature increases is difficult. Projections of a global temperature response to an increase of CO_2 from 300 to 600 ppm vary from 2.0 to 5.0°C (Stone et al. 1988).

Climatic changes and corresponding global impacts as a result of significant warming of the earth's atmosphere are difficult to postulate. It is also very difficult to predict location and magnitude of the potential effects of greenhouse warming on a particular region. The Global Climate Models currently being used are mainly sensitive to large scale and seasonal changes only (Schneider 1989; EPRI 1988). A possible scenario is that the arid regions of the western U.S. could become hotter and drier if global temperatures rose 3°C (Schneider 1989). Other possible changes could result in altered patterns of precipitation and evaporation that could shift agriculturally productive areas. The increased temperature could also cause a melting of the polar ice caps with a subsequent rise in the sea level. There is no certainty that this scenario will occur.

Current estimates of global CO_2 emissions from fossil fuel combustion are about 18 billion metric tons/yr (EPRI 1988). Annual global emission projections of CO_2 for 2050 range from 18 to 92 billion metric tons (National Resources Council 1983; Keppin et al. 1986). These estimates based on the projected usage of energy resources by several investigators demonstrate the wide range of uncertainty in projecting CO_2 emissions. Note that these CO_2 emission projections are from fossil fuel combustion and do not include emissions resulting from tropical deforestation.

Tropical deforestation may be a significant source of greenhouse gas buildup. When forests are leveled and trees burned or left to rot, the carbon in the biomass is released as CO_2. In addition, growing plants absorb CO_2 from the air and, through photosynthesis, fix the carbon in their tissues (EPRI 1988); thus, in addition to creating CO_2 emissions, deforestation removes an important CO_2 sink. Recent estimates of CO_2 release from tropical deforestation range from 0.4 to 3 billion tons/yr (EPRI 1988; Bureau of National Affairs 1988).

4.2 NOISE

4.2.1 STUDY AREA DEFINITION

The project study area is in a remote location in which the major man-made noise sources are trains and vehicular traffic. An initial screening for background noise levels in the vicinity of the project area was performed in April 1989. This study encompassed an area in the Toano Draw within a 12 mile radius of the proposed plant site. Within this study area, the residential sites are approximately 9 miles west-southwest, 8.5 miles northwest, and 14.5 miles south-southeast of the project site. Areas further away which could be affected by project-related noise sources (i.e., increased train activity) include the towns of Montello and Cobre. To characterize these areas, the town of Montello was included in the initial screening effort.

4.2.2 FUNDAMENTALS OF NOISE

There is wide variation in the human perception of noise because of the range in noise intensity (amplitude), pitch (frequency), and time duration (sudden, intermittent, occasional, continuous, etc.). The human ear selectively perceives sound frequencies. To account for this selectivity, measured sound levels are given a weighting factor to more closely resemble human perception. The most common weighting method is called "A-weighting." All references to noise in this report refer to "A-weighted" decibel levels or dBA. Table 4.2-1 contains a list of noise levels on the dBA scale typically experienced in daily activities.

Several measures are used to provide a common basis for characterizing this variability in sound. One of these measures is the equivalent sound level (L_{eq}). This is a measure of the energy-averaged (A-weighted) sound level over a given period of time. For an overall characterization of community noise, it is most convenient to derive a number that is typical of a 24-hour day which accounts for the higher level of disturbance experienced at night when a noise intrudes on a period of sleep or quiet residential activity. To model this nighttime disturbance factor, a common noise measurement is the day-night sound level (L_{dn}). L_{dn} defines daytime hours as 7 a.m. to 10 p.m. and nighttime hours as 10 p.m. to 7 a.m. Noise occurring at night is "penalized" by adding 10 dB to actual sound levels (Hatano 1980). For example, a 70-dB noise level at night would be treated as 80 dB for determining impacts. Generally, L_{dn} is used and recommended for environmental studies by professional groups and Federal agencies such as the Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA). For further information on noise fundamentals, refer to the Noise Technical Report.

4.2.3 NOISE SIGNIFICANCE CRITERIA

There are several noise standards used to interpret the noise levels associated with this project. One is the Federal noise abatement criteria used to protect noise sensitive land uses (Federal Highway Administration [FHWA] 1982a). Another is the HUD acceptability categories for nonaircraft noise. The third is EPA noise levels identified as requisite to protect public health and welfare with an adequate margin of safety. The fourth considered is Occupational Safety and Health Administration (OSHA) criteria for protection of workers. The first three are used as guidelines to evaluate impacts outside of the plant boundaries, while the fourth is used to evaluate the workplace environment. These criteria are explained below.

Federal highway design noise levels for various land use ratings (called activity categories) are given in Table 4.2-2. Most of the land surrounding the project site is undeveloped and thus noise abatement criteria are not designated (Category "D"). The other areas are residential, which include the residences at Winecup Ranch, the east side of Black Mountain, the southwest base of Murdock Mountain, and the towns of Cobre and Montello (Category "B"). The FHWA criteria identify the noise

Table 4.2-1. RELATIVE SCALE OF VARIOUS NOISE SOURCES AND EFFECT ON PEOPLE

PUBLIC REACTION		NOISE LEVEL (dBA)	COMMON INDOOR NOISE LEVELS	COMMON OUTDOOR NOISE LEVELS
		110	Rock Band	
				Jet Flyover at 1000 ft
		100	Inside Subway Train (New York)	
Local Committee Activity with Influential or Legal Action				Gas Lawn Mower at 3 ft
Letters of Protest	4 times as loud	90		
			Food Blender at 3 ft	Diesel Truck at 50 ft
Complaints Likely	Twice as loud	80	Garbage Disposal at 3 ft Shouting at 3 ft	Noisy Urban Daytime
Complaints Possible	Reference			
		70	Vacuum Cleaner at 10 ft	Gas Lawn Mower at 100 ft
			Normal Speech at 3 ft	Commercial Area Heavy Traffic at 300 ft
Complaints Rare	1/2 as loud	60		
			Large Business Office	
Acceptance	1/4 as loud	50	Dishwasher Next Room	Quiet Urban Daytime
		40	Small Theatre, Large Conference Room (Background)	Quiet Urban Nighttime
				Quiet Suburban Nighttime
			Library	
		30		
			Bedroom at night Concert Hall (Background)	Quiet Rural Nighttime
		20		
			Broadcast and Recording Studio	
		10		
			Threshold of Hearing	
		0		

Source: Hatano 1980.

Table 4.2-2. FEDERAL NOISE ABATEMENT CRITERIA, HOURLY A-WEIGHTED SOUND LEVEL - DECIBELS (dBA)[a]

Activity Category	$L_{eq}(h)$	$L_{10}(h)$	Description of Activity Category
A	57 (Exterior)	60 (Exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties, or activities not included in Categories A or B above.
D	--	--	Undeveloped lands.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Source: FHWA 1982a.

[a] Either $L_{10}(h)$ or $L_{eq}(h)$ (but not both) may be used on a project. Note that "h" refers to hourly noise levels.

level at which mitigation should be considered to protect various noise sensitive land uses. For example, 67 dBA is used as the criterion for residential areas.

Guidelines for outdoor noise exposure to nonaircraft noise are provided by HUD (HUD 1971). The HUD categories of noise exposure and their respective noise limits are listed in Table 4.2-3. These limits apply to the boundaries of Federally funded residential developments. Since noise from the power plant would essentially be constant with time, the "Acceptable" category corresponds to sound levels below 45 dBA, the "Normally Acceptable" category corresponds to levels between 45 and 65 dBA, the "Normally Unacceptable" category corresponds to levels between 65 and 75 dBA, and the "Unacceptable" category corresponds to levels above 75 dBA.

EPA guidelines (EPA 1974) for noise levels to protect public health and welfare with an adequate margin of safety are presented in Table 4.2-4. For example a L_{dn} of 55 dBA is used as a criterion in residential areas for avoidance of interference and annoyance to outdoor activities.

OSHA regulations (29 CFR Ch. XVII, 1910.95) stipulate a maximum noise level that should not be exceeded based on the period of exposure. For example, workers should not be exposed to noise levels greater than 90 dBA over an 8-hour period. Exceedance of this standard requires consideration of a noise abatement program and work protection measures.

4.2.4 NOISE SURVEY

Nine monitoring sites were selected for measuring noise in the study area (Figure 4.2-1). Six noise survey locations were in the Toano Draw (S-4 through S-9) two were in the town of Montello (S-1 and S-2), and one was in Loray Wash (S-3).

A total of 10 noise measurements were taken at the nine monitoring sites to assess current background noise levels. Measurements were taken in hourly L_{eq}s, 24-hour L_{eq}s, and L_{dn}s at survey locations S1, S3, and S9. The town of Montello, survey location S1, had a maximum 1-hour L_{eq} of 57 dBA, while the survey locations approximately 100 feet from railroad tracks, S3 and S9, had maximum 1-hour L_{eq}s of 71 and 69 dBA, respectively.

Half-hour L_{eq}, L_{10}, and L_{90} measurements were taken at sites S2, S4, S6, S7, and S8, and 24-hour L_{eq}, L_{10}, and L_{90} values at S5. Survey location S2 in Montello had a half-hour L_{eq} of 46 dBA. The Winecup Ranch site, S4, had a morning half-hour L_{eq} of 33 dBA. The future plant site, S5, had a 24-hour L_{eq} of 33 dBA. The three survey locations S6, S7, and S8 each had half-hour L_{eq}s between 22 and 26 dBA.

Noise levels associated with train activity were measured at survey location S9 during the 24-hour period of the monitoring survey noted above. The 24-hour L_{eq} measured at S9 was 63 dBA. Train passage monitoring at the same location showed short-term noise levels ranging from 73 to 83 dBA per train passage.

Table 4.2-3. HUD'S ACCEPTABILITY CATEGORIES FOR NONAIRCRAFT NOISE

Acceptable	- Noise level does not exceed 45 dBA for more than 30 minutes per 24 hours
Normally Acceptable	- Noise level does not exceed 65 dBA for more than 8 hours per 24 hours
Normally Unacceptable	- Noise level exceeds 65 dBA for more than 8 hours per 24 hours
Unacceptable	- Noise level exceeds 75 dBA for more than 8 hours per 24 hours
	- Noise level exceeds 80 dBA for more than 60 minutes per 24 hours

Source: HUD 1971

Table 4.2-4. SUMMARY OF EPA NOISE LEVELS IDENTIFIED AS REQUISITE TO PROTECT PUBLIC HEALTH AND WELFARE WITH AN ADEQUATE MARGIN OF SAFETY

Effect	Level	Area
Hearing loss[a]	$L_{eq(24)} \leq 70$ dBA	All areas
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dBA	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} \leq 55$ dBA	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dBA	Indoor residential areas
	$L_{eq(24)} \leq 45$ dBA	Other indoor areas with human activities such as schools, etc.

Source: EPA 1974

[a] The hearing loss level identified here represents annual averages of the daily level over a period of 40 years. (These are energy averages, not to be confused with arithmetic averages.)

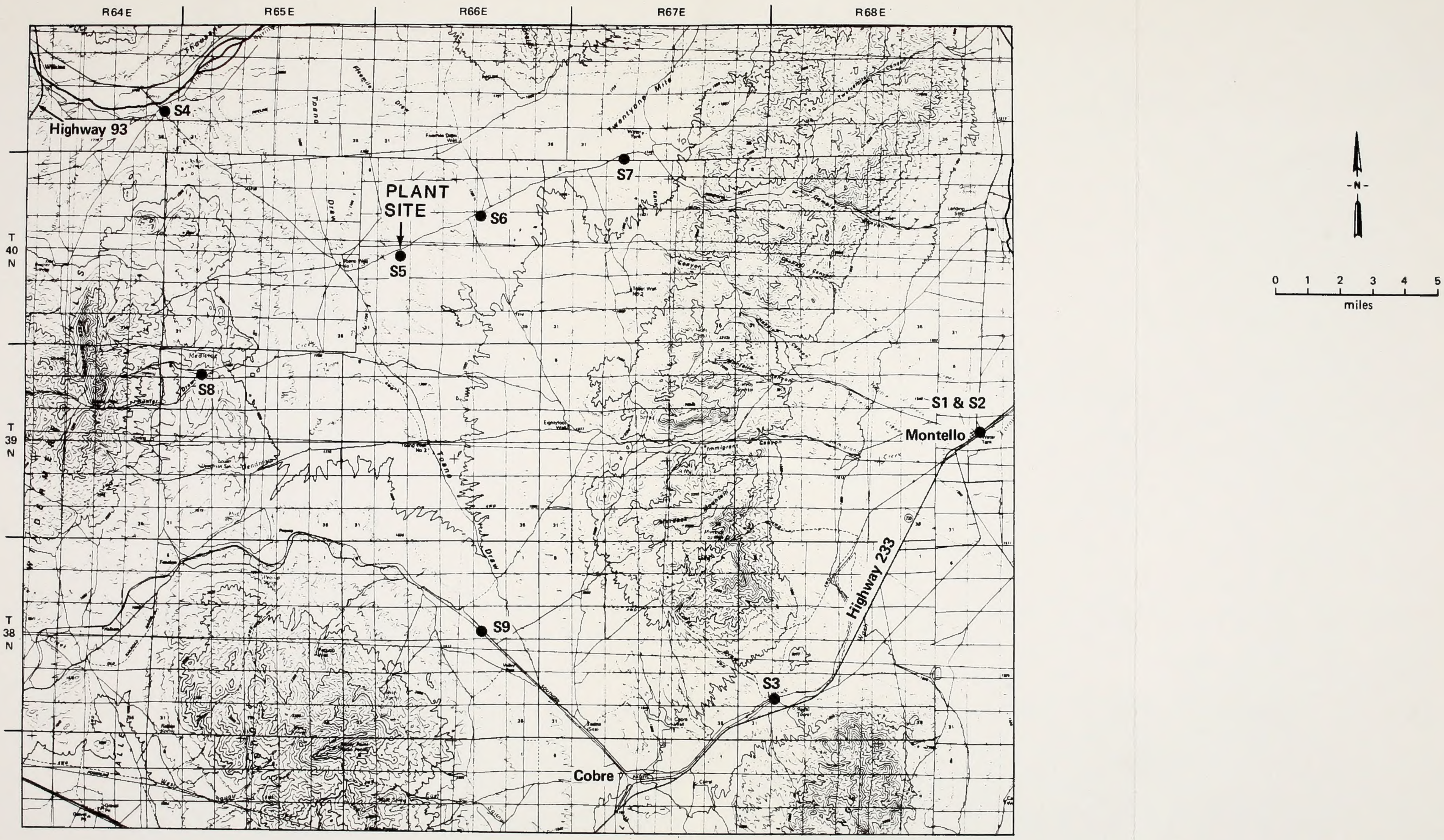


Figure 4.2-1. NOISE SURVEY LOCATIONS

In summary, results from the baseline noise study confirmed noise levels that would be anticipated for a rural, desert environment. All monitoring data are presented in the Noise Technical Report for this project.

4.3 GEOLOGIC CONSIDERATIONS

4.3.1 STUDY AREA DEFINITION

Thousand Springs Valley is located within the northern Great Basin, the northern portion of the Basin and Range Physiographic Province, a tectonically active region characterized by active uplift and moderate to high levels of seismicity. The region is typified by Basin-Range structure, expressed as north/south-trending isolated mountain ranges bounding internally drained, deeply alluviated valleys. Elevations within the province, on the average, range from 4300 to 5250 feet in the valleys to 6500 to 10,000 feet along the mountain crests (Stewart 1978).

Locally, the project site is situated within Toano Draw, a slightly elongate, north/northwest-trending basin (Figure 3.1-1). This 22-mile-long and up to 15-mile-wide valley has an elevation of about 5700 feet at the proposed plant site. The northern end of the valley is crossed by northeast-trending Thousand Springs Creek. Toano Draw is bounded by the 7400-foot Knoll Mountains to the northwest, the 7900-foot Windermere Hills to the west, the 8100-foot Pequop Mountains to the southwest, the 7900-foot Toano Range to the southeast, the 8400-foot Gamble Range to the east, and 7400-foot Ninemile Mountain to the northeast. Valley Pass, at an elevation of about 6040 feet, separates Toano Draw from Goshute Valley to the south.

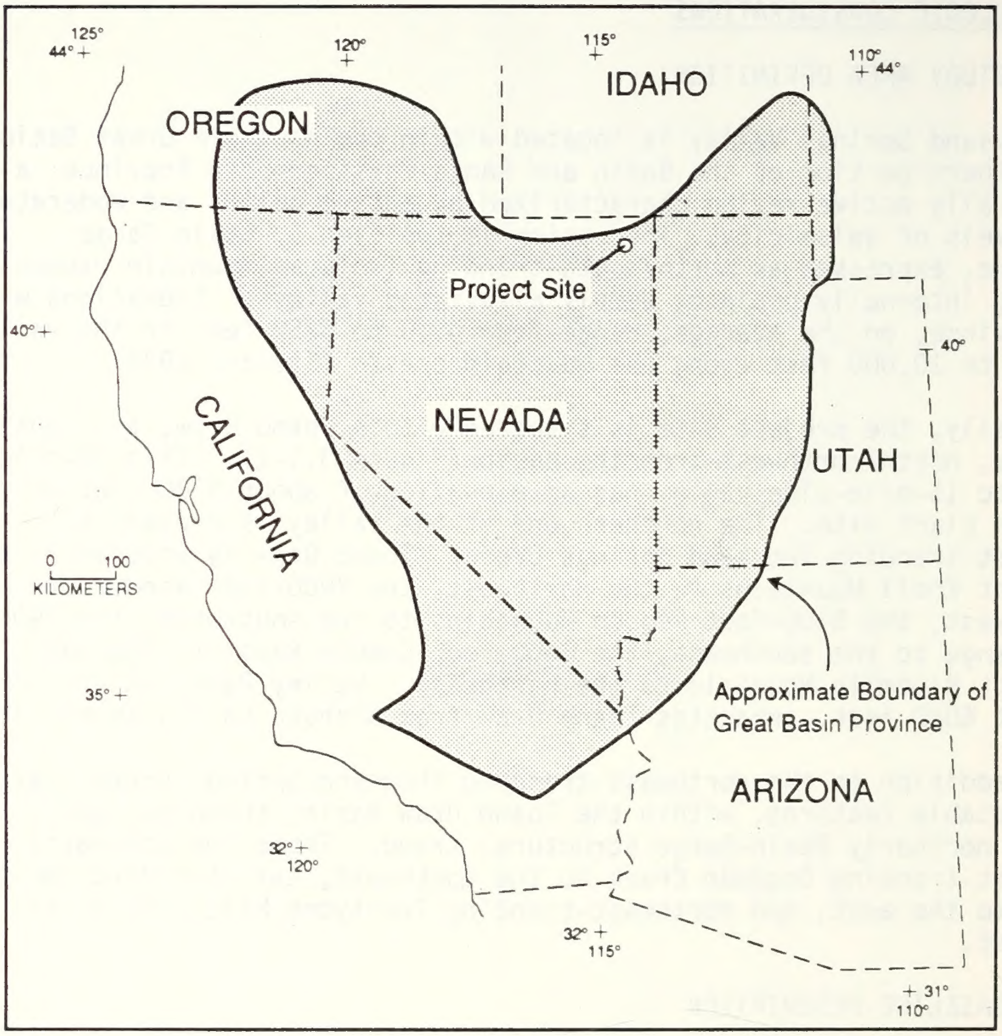
In addition to the northeast-trending Thousand Springs Creek, several other notable features, within the Toano Draw Basin, trend obliquely to the general northerly Basin-Range structural trend. These include east/northeast-trending Deadman Creek to the southwest, east-trending Immigrant Canyon to the east, and northeast-trending Twentyone Mile Draw to the northeast.

4.3.2 BASELINE DESCRIPTION

A detailed study of the geology of Toano Draw Subbasin was conducted during the water resource evaluation of Thousand Springs Basin by Woodward-Clyde Consultants (WCC) and is reported in the Water Resources Technical Report.

4.3.2.1 Regional Geology

The Great Basin Province (Figure 4.3-1) is comprised of a diverse array of rock types and ages from Precambrian (800 to 1600 million years before present) crystalline rocks to Holocene unconsolidated valley fill deposits (Stewart 1978). Late Precambrian rocks were deposited within the Cordilleran geosyncline and are comprised of continental margin sediments and volcanics. This elongate basin extended through Canada to Mexico and occupied nearly the entire area that is now Nevada.



Source: Modified from Wallace 1984.

Figure 4.3-1 LOCATION OF THE PROPOSED THOUSAND SPRINGS POWER PLANT WITHIN THE GREAT BASIN PROVINCE

Later, during the Mesozoic Era, tectonics within the Basin and Range province were dictated by subduction along the west coast of North America (Stewart 1978). This was characterized by two primary periods of deformation, the Sevier (latest Jurassic to Cretaceous) and the Laramide (latest Cretaceous to Eocene) orogenies, extending along a belt of folding and thrusting from Canada to Mexico (Burchfiel and Davis 1975; Stewart 1978).

Early and middle Cenozoic time was marked by periods of silicic (rhyolitic and andesitic) volcanism throughout the eastern and southeastern Great Basin.

Late Cenozoic time marked the beginning of the tectonic and igneous activity that developed the present structure of the Basin and Range province (Hunt 1979; Stewart 1978). Great volumes of bimodal basaltic rocks were extruded and extensional tectonics began, initiating Basin-Range structure characterized by generally north-trending complex systems of normal faults which have resulted in uplift of linear portions of Precambrian to Mesozoic sediments to form mountains and sinking of adjacent sediments to form basins (Stewart 1978).

4.3.2.2 <u>Geology of the Selected Lands</u>

Locally, the geology is consistent with the regional geologic framework. The surrounding ranges, the Windermere Hills, Pequop Mountains, Gamble Range, and Ninemile Mountain, consist principally of a core of Cambrian to Permian limestone and lesser dolomite of the Pequop Formation (Hope and Coats 1976), mudstones, siltstones, and granitic intrusive rocks and Mesozoic marine sediments. These core rocks have been rotated by range-bounding normal faults resulting in strata dipping between 20 and 45 degrees away from Toano Draw.

Tertiary rhyolites, andesites, and associated tuffaceous sediments are exposed at the surface along both margins of Toano Draw, adjacent to the Paleozoic core of the mountains, and along the northern margin of the basin. Normal faults along the range fronts on both sides of Toano Draw have rotated the volcaniclastic units so that bedding dips steeply toward the mountains (greater than 60°) and away from the center of the valley (BLM 1986c).

Late Tertiary and Quaternary deposits primarily include alluvial fans and channelized alluvium. Coalescing alluvial fans form the extensive bajada that occupies the majority of Toano Draw. The upper reaches of the fans are in faulted contact with Tertiary volcanic rocks. The channelized alluvium occurs as channel fill, gravel bars, and terrace remnants within Toano Draw, Fivemile Draw, Twentyone Mile Draw, Thousand Springs Creek, and within the numerous small, shallow tributary channels that drain into Toano Draw from the mountains and hills. Minor pluvial lakes occupied the lower elevations of the basin in late Tertiary and Pleistocene time depositing coarse beach gravels and sands along the lake margins grading to fine sands to clay toward the valley center. Similar deposits within the valley may be attributed to damming along Thousand Springs Creek.

Numerous faults occur in the Thousand Springs Basin. Zones of faults located within the Great Basin that displace Tertiary or younger deposits are shown on Figure 4.3-2. Older faults, apparently displacing pre-Cenozoic rocks, are depicted in the geologic map of Elko County by Hope and Coats (1976).

4.3.2.3 Geology of the Offered Lands

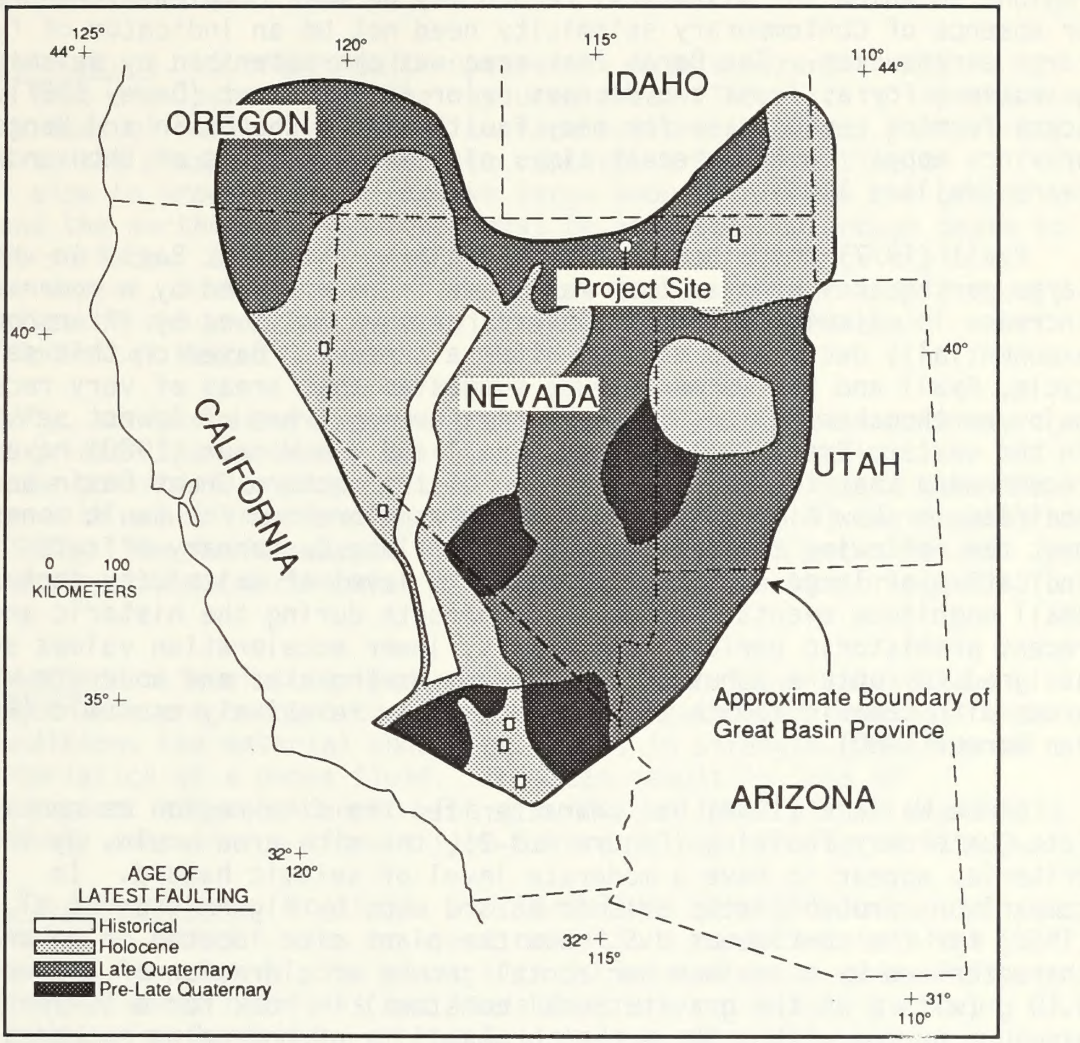
The offered lands are located along the eastern margin of the Snake Mountains range, west of the Toano Draw Basin. The Snake Mountains range, a north/south-trending Basin and Range-style fault-bounded block, is bordered by a part of the Thousand Springs Valley to the east and Tabor Creek Valley to the west (BLM 1986c). The highest part of the Snake Mountains, Antelope Peak, is 8789 feet.

The geology of the eastern Snake Mountains is similar to that of the offered lands in the Toano Draw Basin (see Water Resources Technical Report for a detailed description of the geologic units). Hope and Coats (1976) mapped Paleozoic limestone and dolomite along with late Ordovician to Devonian siliceous volcanic rocks within the core of the mountains. These rocks are, in part, in faulted contact with Tertiary silicic volcaniclastic sediments and late Tertiary to Quaternary alluvial fan deposits. These sediments prograde eastward where they are truncated by Quaternary (including Holocene) channelized alluvial sediments in the center of the valley.

4.3.2.4 Seismicity

The plant site is located within the northern margin of the Great Basin south of a prong of the Columbia Plateau. The Great Basin, the northern portion of the Basin and Range province (Figure 4.3-2), is a tectonically active region characterized by active uplift and crustal extension, and in general, a moderate to high level of seismicity. Much of the current seismicity within central Nevada may be related to a decaying level of aftershock activity asociated with large historical earthquakes such as the 1954 Fairview Peak and Dixie Valley events (magnitude 7.1 and 6.8) in west-central Nevada (Ryall and Van Wormer 1980). Fault scarps also attest to the occurrence of recent large normal faulting earthquakes (magnitude 7 and greater).

In apparent contrast, the plant site occurs within a portion of the Great Basin which has historically exhibited a low level of seismicity. It appears that no known earthquake of magnitude 5.0 or greater has occurred in the site region (bounded by latitudes 40-42°N and longitudes 114-116°W), with fewer than 25 known events of magnitude between 3.0 and 5.0. This apparent relative lack of seismicity may be in part due to the inability to detect earthquakes because of the relatively poor seismographic coverage of the region and to some extent, the sparse population. Even at present, the nearest seismograph to the plant site is a station operated by the University of Nevada at Reno near Battle Mountain, approximately 125 miles away.



Source: Modified from Wallace 1984.

Figure 4.3-2 THE GREAT BASIN PROVINCE SHOWING ZONES OF QUATERNARY FAULTING.

Thus, the historical earthquake record for the site region is incomplete, and, as is the case for much of the Basin and Range province, inadequate to quantify the level of seismic hazard that may exist. In other portions of the province, the occurrence of large earthquakes such as the magnitude 7.3 1983 Borah Peak, Idaho earthquake suggests that even for regions in which the historical record may be more complete, the presence or absence of contemporary seismicity need not be an indicator of future large earthquakes. The Borah Peak area was characterized by seismic quiescence for at least two decades prior to the event (Dewey 1987). Large scarp-forming earthquakes for many faults within the Basin and Range province appear to have repeat times of several to tens of thousands of years (Wallace 1984).

Ryall (1977) described a seismic cycle in the Great Basin in which large earthquakes greater than magnitude 7 are preceded by a moderate increase in seismicity lasting several decades followed by aftershocks that exponentially decay to a minimum after a century. Based on this seismic cycle, Ryall and Van Wormer (1980) suggested that areas of very recent major earthquakes may be, in a relative sense, areas of lowest seismic risk in the western Great Basin. Thus, Ryall and Van Wormer (1980) have recommended that the seismic zonation of the western Great Basin be modified to show high values of maximum acceleration for fault zones that meet the following criteria: evidence of late Quaternary offsets indicative of large earthquakes, moderate level of seismicity including small magnitude events, and no major offsets during the historic and very recent prehistoric period. Conversely, lower acceleration values should be assigned to rupture zones of very recent earthquakes and moderate values to areas with capable faults that are presently relatively aseismic (Ryall and Van Wormer 1980).

Since Wallace (1984) has characterized the site region as containing late-Quaternary faulting (Figure 4.3-2), the site area would, by these criteria, appear to have a moderate level of seismic hazard. In comparison, probabilistic seismic hazard maps by Algermissen et al. (1982) for the contiguous U.S. show the plant site located in an area characterized by a maximum horizontal ground acceleration of approximately 0.10 g (with g as the gravitational constant) in rock for a 50-year exposure period with a 90 percent probability of not being exceeded. These probabilistic maps are valuable in providing a guide to the relative level of hazard in a given region; however, there is a lack of detailed seismologic and geologic information in many areas of the U.S., such as the site region. It should also be noted that within the Intermountain seismic belt, on the eastern margin of the Great Basin, earthquakes up to magnitude 6.5 can also occur, apparently unassociated with surface faults (Doser 1985).

4.3.2.5 Geologic Hazards

Earthquake-Induced Hazards on Selected Lands.

Strong Ground Motion. Several range-front faults, located within the Toano Draw Basin, lie within several miles of the proposed power plant

site. Basin and Range faults are capable of producing moderate to large (magnitude greater than or equal to 6.8) earthquakes (Wallace 1984). However, paleoseismic evidence suggests that intervals of several hundred to more than 10,000 years exist between periods of rupture on an individual fault (Wallace 1984). The ages of last rupture on the faults within the basin are not known.

Surface Rupture. Surface fault rupture can pose a hazard to any facilities that are located over the ruptured area. Thus, it is important to locate traces of faults capable of surface rupture. Several factors may contribute to the possibility of surface rupture; a fault must be of sufficient size to produce an earthquake large enough to break the ground surface, and the earthquake hypocenter must be at a shallow enough depth to rupture the surface. Surface traces of several Basin and Range-style faults were mapped, during the water resources evaluation for this project, within 5 miles of the proposed plant site (Figure 3-1 of the Water Resources Technical Report).

Typically, surface displacement is associated with at least moderate (magnitude greater than or equal to 5), shallow-focus earthquakes. However, some potential exists for small surface displacements to occur in association with small (magnitude greater than or equal to 3) earthquakes (Bonilla 1988). The faults mapped within 5 miles of the plant site are large enough to produce earthquakes of magnitude greater than or equal to 3.

Liquefaction. Liquefaction generally occurs when loose saturated granular materials are exposed to strong earthquake-induced shaking. Under certain conditions the material undergoes a loss in strength and takes on the characteristics of a dense fluid. This can result in loss of foundation support and subsidence. The groundwater level at the plant site is sufficiently deep that a liquefaction hazard is not considered likely.

Rockfalls/Landslides. Rockfalls and landslides generally occur in areas of unstable, steep slopes or where conditions conducive to slope instability are introduced. The plant site is located in an area of low to moderate terrain where rockfalls and landslides are not likely to occur. A potential exists for landslides or rockfalls along potential water transport and railroad lines, if they are located in steep terrain.

Debris and Mudflows. Debris and mudflows generally occur when saturated, unconsolidated material becomes mobilized. This fluid-like material is sufficiently dense to incorporate relatively large clasts and is generally confined to stream and tributary channels. Saturated material on a hillslope is even more prone to movement when subjected to seismic shaking. The present plant site is located within an area of arroyos that may provide a potential pathway for debris and mudflows. This potential hazard can be mitigated by minor relocation of facilities, by design of structures to deflect or control such flows, or by redirection of channels.

Other Geologic Hazards.

Subsidence. Groundwater withdrawal from alluvial aquifers can result in a volumetric change in the subsurface materials. This may result in compaction of the layer and displacement of overlying surface materials. Because the depth to groundwater is sufficiently deep to minimize subsidence effects, this potential hazard is not considered to be likely.

Flooding. The proposed plant site is located adjacent to or within alluvial channels which may be subjected to periods of flooding. Floodplain mapping, normally available from the Federal Emergency Management Agency does not exist for the project region because of its undeveloped rural nature. This agency generally maps floodplains in developed areas where risk to property damage is greatest.

4.3.2.6 Mineral Resources

This section discusses the known mineral resources of the selected and offered lands.

Mineral Resources on Selected Lands. BLM (1986c) discusses two mining districts within the vicinity of the selected lands. The Black Mountain District, in the Windermere Hills, is defined by two prospects within a strontium-bearing barite and calcite breccia zone within the Nevada Formation, a Devonian marine limestone. The other district, the Montello Phosphate area in southern Gamble Range, contains a low-grade phosphate shale. No production has come from either area. Neither area lies within 6 miles of the selected lands.

BLM (1986c) discusses sand and gravel as the only salable commodity within the boundaries of the selected lands. However, this material is of poor quality because of the abundance of "fines" due to alluvial fan deposition. Furthermore, other sources for this material are plentiful on nearby public and private lands. The BLM report lists all the selected lands as being prospectively valuable for oil and gas. No other resources are discussed.

Mineral Resources on Offered Lands. BLM (1986c) reports the occurrence of barite mining and related surface disturbances on offered lands in the Snake Mountains. The offered lands in Toano Draw have the same mineral resource values as those described under selected lands above. These disturbances include two open pits, haulage roads, trenches, and access roads occupying 172 acres, or less than 1 percent of the offered lands. Mining activity has occurred in the following offered lands:

- T41N, R62E, Sections 16, 21, 22, 26, 27, 28
- T40N, R62E, Sections 2-15, 26, 32, 34, 35

As reported in BLM (1986c), Nevada leads all states in barite reserves most of which are in bedded deposits. Domestic mines provided only 35 percent of the U.S. total barite supply in 1983; the remaining 65 percent was imported. In many cases, the shipping rate from foreign nations (e.g.,

China, Morocco, Chile, Peru) to ports on the U.S. Gulf Coast is cheaper than shipment by rail from Nevada. The small increase in domestic production observed in 1984 is in part due to lower domestic rail rates and the increased use by major producers of "unit trains" and guaranteed tonnage contracts with rail carriers. However, Nevada production decreased by 7 percent during the same period.

In addition, volcaniclastic sediment deposits in the Snake Mountains have the moderate potential of yielding metals commonly found in other volcanogenic massive sulfide deposits such as copper, zinc, lead, silver, gold, selenium, tin, and bismuth. There is limited potential for oil and gas resources (BLM 1986c). The BLM holds no authority over the exploration or development of these lands, as no mineral resources would be exchanged in the proposed action.

4.4 SOILS

Soil represents an important link between the physical and biological worlds, as it provides the basis for vegetation growth and terrestrial life. Soil is also important because of its influence on the success and feasibility of various construction activities. Certain soil types can pose difficult problems or limitations to proposed project actions and, in turn, can be more sensitive to the effect of these actions. The soil types located in the project study area are discussed below.

4.4.1 STUDY AREA DEFINITION

The study area for soils includes lands involved in the proposed land exchange (Figure 3.1-1); and the plant site (approximately 1240 acres) and proposed ancillary linear facilities (approximately 540 acres) (Figure 3.1-2).

Information on soils in this study area was obtained from a number of unpublished soil survey documents and maps, authored by the Soil Conservation Service (SCS) and provided by the Elko District Office of the BLM (SCS undated (a), (b)). The documents include descriptions and interpretations for various soil associations found within the study area. This information was reviewed to identify soil characteristics in relation to construction and operation of the proposed power plant and ancillary facilities. These soil characteristics include:

- Slope
- Water and wind erosion potential (as interpreted by the SCS, taking into account inherent soil characteristics, slope, climatic factors)
- Reclamation potential (as indicated by the SCS rating of topsoil conditions and rangeland seeding potential)

- Potential for road-building problems (as indicated by the SCS interpretation, which takes into account such factors as presence of hardpan, stones, soil depth, strength, shrink/swell characteristics, and frost action)

- Potential for construction/excavation problems (as indicated by the SCS interpretation, which takes into account such factors as soil depth, stones, cut bank stability, and hardpan)

The latter two characteristics (roadbuilding and construction/excavation suitability) include limitations that do not preclude development, but often require changes in design or additional mitigation.

A general description of the soil associations is provided for the exchange lands. For the plant site and ancillary facilities, tables are provided in the Soils Technical Report which give specific information on the soil characteristics for each soil type affected by a proposed project facility. Tables 2-1 through 2-6 in the Technical Report also indicate the approximate percentage of the route or, in the case of the power plant site itself, approximate acreages, within the indicated soil type. A single table for the power plant site and individual tables for the proposed access road, railroad, water pipeline, and alternative access roads are provided. These tables form the basis for determining areas of potential impact.

4.4.1.1 <u>Exchange Lands</u>

With the exception of one section of land northeast of the plant site, the offered lands are located within an area of the Snake Mountain Range and associated alluvial fans to the east. Several small creeks or draws originate in the mountains and drain east through the offered lands. The following discussion gives a qualitative description of the dominant soil types in this area.

The mountain tops and slopes possess soils that are moderately steep to very steep, shallow to deep, and well-drained. The Cleavage soil series is extremely common and is the dominant soils series for four of the major soil associations found in the mountain area. In addition, there are also large areas of Tusel-Belsac Association soils and Gollaher-Hackwood soils. All of these soils are very gravelly, stoney, or cobbly loams or silt loams, and are derived from apparent material consisting of colluvium or residuum from various rock sources. Slopes range from 4 percent on lower hills up to 75 percent, with 15 to 50 percent slopes being the most frequently reported. Several areas have moderate to high water erosion potential, and all the predominant soils exhibit characteristics that make any construction activity extremely difficult to perform or to mitigate (stones, gravel, shallow depth, etc.).

The piedmont or alluvial fan area east of the Snake Mountain Range consists of gently sloping to steep, shallow to deep, well-drained soils, most of which are alluvial deposits. The most common soil associations are

two Donna series associations and the Chen-Coser Association. All these soils are gravelly loams, with slopes ranging from 2 to 15 percent, and generally have poor topsoil conditions. A cemented hardpan occurs in Donna series soil at a depth of about 2 to 3 feet.

The one section of offered land located to the northeast of the proposed power plant site consists primarily of a Cobre series-dominated association. This is a gently-sloping silt or gravelly loam, with fair to poor topsoil characteristics, found on the slopes. Also, a small portion of a draw in this section contains a mixed alluvial deposit, a silt loam with very slight slopes, and generally fair topsoil conditions.

The selected lands comprise the other portion of this study area. Because these lands follow the linear patterns of the proposed ancillary facilities, they cover a large geographic area and include a wide range of geological, topographic, vegetative, and climatic conditions, and therefore, a wide range of soil types. These soil types are found within the lands that would be directly affected by the proposed access road, alternative access roads, and railroad construction. For purposes of qualitative comparison with the offered lands, the following general description of the selected lands is provided:

- Proposed railroad - this route contains large sections of soils of the Chiara and Peeko series, and also the Wiffo-Nevador Association. All of these soil types are gently to strongly sloping, well-drained, and located on fan piedmont remnants. The Chiara and Peeko soils have a cemented pan; all sections have generally fair to poor topsoil conditions and seeding potential.

- Proposed access road - this route consists of gently to strongly sloping, well-drained soils on fan skirts and piedmont fan remnants (Peeko series, Wiffo-Nevador Association). There is also a relatively large area of Valmy soil series associations, which are generally fine silt loams, found along floodplains and stream terraces, plus some additional Toano series floodplain soils. These latter two soil types are found along the various streams in the area and generally have better topsoil, better seeding potential, and very slight slopes.

- Moor Summit alternative access road - this route covers the greatest variety of soil types, because of its length and the diverse topography found along the route. Associations with the largest representation along this corridor include the Peeko, Chiara, and Wiffo-Nevador soils discussed above, plus associations containing the Gochea soil series. The Gochea soils are gravelly silt loams found along valley fans and piedmont remnants. Other types of soils, including very steep, cobbly soils, and floodplain deposits, are also represented along this route.

- Brush Creek alternative access road - this route consists of about one-third arid and stony cemented hardpan. Another large portion, approximately one-half of the route, consists of Wiffo-Nevador and Valmy-Enko soils, which are also stony and arid or droughty. The Hundraw Association (approximately 16 percent of the route) may present some slopes and has a shallow depth to rock. A few small segments pass over stream floodplains, which are generally better soils, although the Sonoma Association in the Brush Creek Valley is known for flooding and excess salts.

4.4.1.2 Proposed Plant Site and Ancillary Facilities (Proposed and Alternative Access Roads, Railroad, Water Pipeline)

Soils of this study area would be directly affected by the proposed project activities and would also pose certain limitations or problems for construction of facilities. Tables 2-1 through 2-6 in the Soils Technical Report present a description of the affected environment soils in a tabular format, with emphasis on those soil characteristics that would have important roles in determining both impacts and construction limitations. Generally, nearly all of the soils associated with the plant site exhibit problems with reclamation potential because of poor topsoil conditions and/or poor rangeland seeding potential. Few are considered "good" seeding base soils, but these still have "poor" topsoil conditions, which, from a conservative viewpoint, may present limitations to successful reclamation planting. In addition, most of the soils identified exhibit characteristics which indicate potential problems with either road-building or construction (shallow excavation), such as the presence of stones, cemented pan, low strength, high shrink/swell potential, cut bank instability, or steep slopes. These limitations do not preclude development, but could result in design or mitigation plans. A few soils have high water erosion potential, as determined by their inherent characteristics and slope, although most are considered to have only a slight or moderate water erosion potential. None of the soils exhibit any more than a slight wind erosion potential. Slopes for these soils range from 0 to 2 percent for floodplain locations to greater than 40 percent in some hilly and mountainous areas. The piedmont fan soils generally have gentle to moderate slopes in the 8 to 15 percent range.

4.5 WATER RESOURCES

This section discusses the geographic area of influence and baseline conditions for water resources of Thousand Springs Basin and land exchange areas. Additional information is included in the Water Resources Technical Report.

4.5.1 STUDY AREA DEFINITION

The study area, extends from the Snake Mountains on the west to the Utah stateline on the east, and the watershed divide of the Thousand Springs Basin on the north and south (Figure 4.5-1). Thousand Springs Basin is a 1450-square-mile basin which includes seven subbasins (Rush

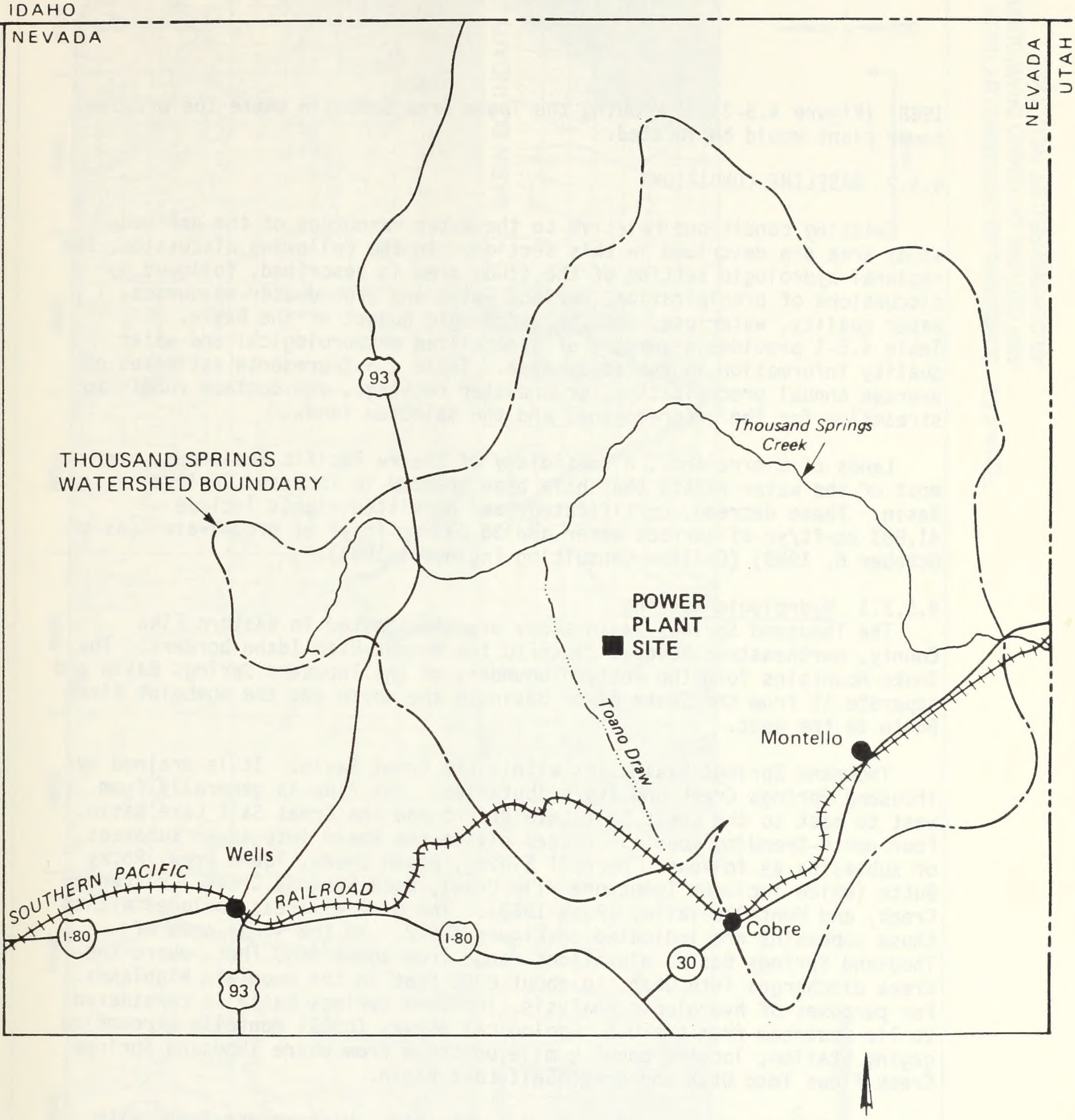


Figure 4.5-1. WATER RESOURCES STUDY AREA

1968) (Figure 4.5-2), including the Toano Draw Subbasin where the proposed power plant would be located.

4.5.2 BASELINE CONDITIONS

Existing conditions relative to the water resources of the defined study area are described in this section. In the following discussion, the regional hydrologic setting of the study area is described, followed by discussions of precipitation, surface water and groundwater resources, water quality, water use, and the hydrologic budget of the Basin. Table 4.5-1 provides a summary of generalized meteorological and water quality information in the study area. Table 4.5-2 presents estimates of average annual precipitation, groundwater recharge, and surface runoff to streamflow for the offered lands and the selected lands.

Lands of Sierra Inc., a subsidiary of Sierra Pacific Resources, owns most of the water rights that have been granted in Thousand Springs Basin. These decreed, certificated, and permitted rights include 41,983 ac-ft/yr of surface water and 36,033 ac-ft/yr of groundwater (as of October 6, 1989) (Chilton Consulting Engineers 1989).

4.5.2.1 Hydrologic Setting

The Thousand Springs Basin study area is located in eastern Elko County, northeastern Nevada, close to the Nevada-Utah-Idaho borders. The Snake Mountains form the western boundary of the Thousand Springs Basin and separate it from the Snake River Basin to the north and the Humboldt River Basin to the west.

Thousand Springs Basin lies within the Great Basin. It is drained by Thousand Springs Creek and its tributaries. The flow is generally from west to east to the Great Salt Lake Desert and the Great Salt Lake Basin. Four north-trending mountain ridges divide the Basin into seven subareas, or subbasins as follows: Herrell Siding, Brush Creek, Toano Draw, Rocky Butte (which includes Twentyone Mile Draw), Rock Springs Creek, Crittenden Creek, and Montello Valley (Rush 1968). The general areas included within those subbasins are indicated on Figure 4.5-2. In the study area of Thousand Springs Basin, elevations range from about 4650 feet, where the creek discharges into Utah, to about 8900 feet in the mountain highlands. For purposes of hydrologic analysis, Thousand Springs Basin is considered to lie upstream from the U.S. Geological Survey (USGS) Montello streamflow gaging station, located about ½ mile upstream from where Thousand Springs Creek flows into Utah and Great Salt Lake Basin.

The climate of the study area is semi-arid. Winters are long, with snow on both valley floors and mountains. Summers are short, with warm daytime temperatures and cool nights. Winter precipitation includes snowfall and rainfall, most frequently from frontal storms. Summer precipitation occurs mainly during thunderstorms.

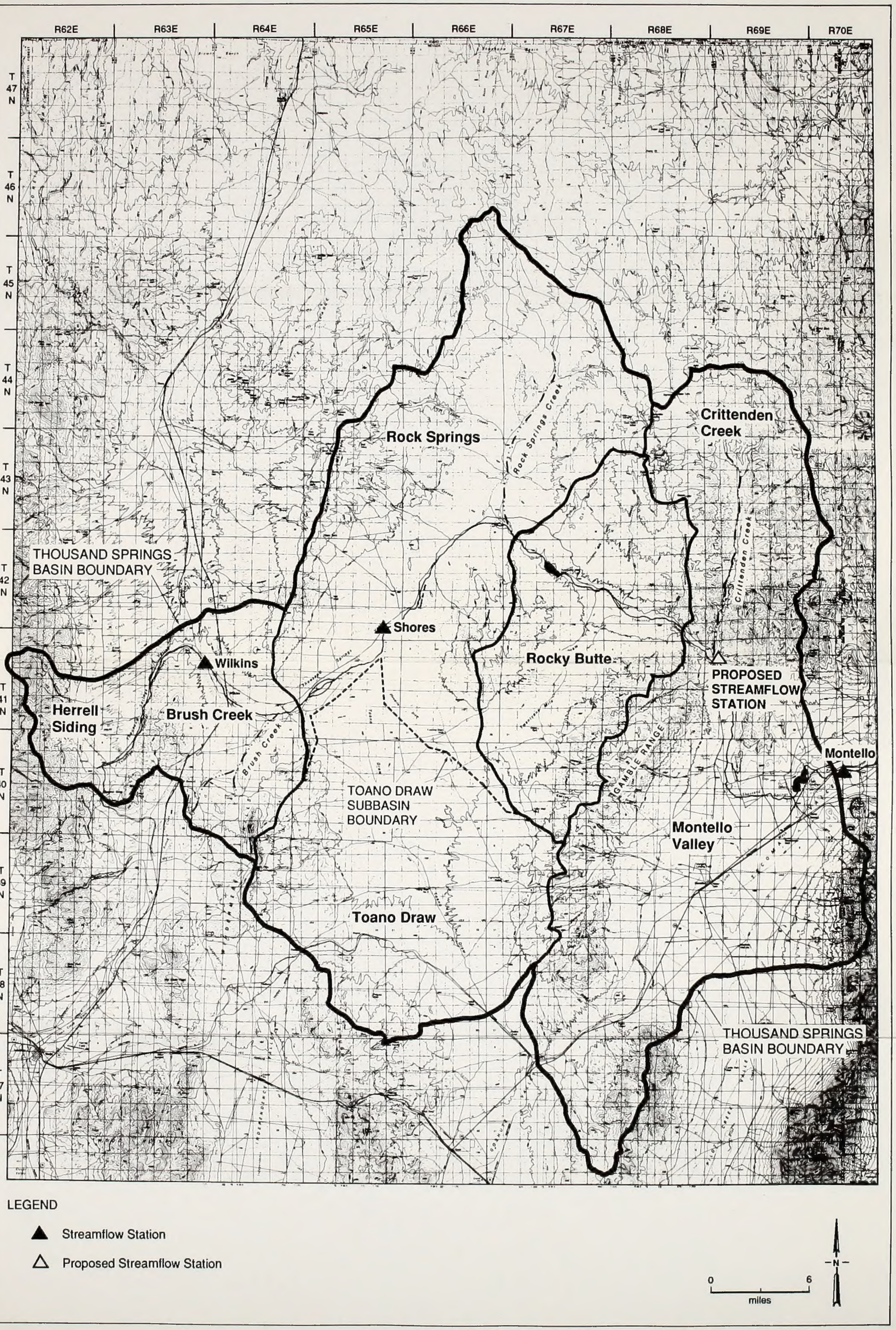


Figure 4.5-2 SUBBASINS AS DESCRIBED BY RUSH (1968) AND OUTLINE OF TOANO DRAW SUBBASIN AS CONSIDERED BY WCC (1989)

Table 4.5-1. REPRESENTATIVE METEOROLOGICAL AND WATER QUALITY PARAMETERS, THOUSAND SPRINGS BASIN AND VICINITY

Meteorological Information[a]	
Normal Daily Average Air Temperature for January, °F	25
Normal Daily Average Air Temperature for July, °F	70
Mean Annual Number of Days, Maximum Air Temperature of 90°F and above	15
Mean Annual Number of Days, Minimum Air Temperature of 32°F and above	190
Normal Annual Total Precipitation, inches (1931-1960)	12
Mean Annual Total Snowfall, inches	60
Mean Annual Pan Evaporation, inches	55
Mean Annual Lake Evaporation (or Evaporation from Open-Water Surface), inches	40
Annual Relative Humidity, percent	55
Generalized Supplementary Meteorological Information[b]	
Annual Number of Days with Thunderstorms	25
Annual Number of Days with Snowfall	14
Generalized Water Quality Information[b]	
Dissolved Solids Content of Surface Water, ppm	>350
Hardness of Surface Water as $CaCO_3$, ppm	120 to 180
Hardness of Groundwater as $CaCO_3$, ppm	120 to 180
Dissolved Solids Content in Public Water Supplies, ppm	250 to 500

[a] National Oceanic and Atmospheric Administration (NOAA) 1968.

[b] Geraghty et al. 1973

Table 4.5-2. ESTIMATED AVERAGE ANNUAL PRECIPITATION, GROUNDWATER RECHARGE, AND RUNOFF TO STREAMFLOW FOR EXCHANGE LANDS

	Elevation, Meters		Precipitation		Net Groundwater Recharge		Streamflow
Area, Acres[a]	Range [b]	Estimated Mean[c]	Estimated Mean (in.)[c]	ac-ft[c]	Percent of Precipitation[d]	ac-ft	ac-ft[e]
OFFERED LANDS							
In Snake Mountains Draining to Snake River							
2782	1880-2520	2200	17.0	3950	0	0	780
In Snake Mountains Draining to Thousands Springs Creek							
9992	1880-2520	2100	15.6	13,200	0	0	2810
In Toano Draw Subbasin							
640	1720-1780	1760	11.4	610	3	18	5
SELECTED LANDS							
In Toano Draw Subbasin							
15,962	1700-1840	1760	12.0	15,940	3	480	125

a) Based on areas of parcels listed in Table 3.1-1.
b) Elevation of each parcel was estimated from USGS 1:100,000 Wells topographic map, and range was extremes from parcels grouped by line in this table.
c) Mean precipitation on each parcel was estimated from the orographic relationship developed in the Water Resources Technical Report. Mean elevation and precipitation for each group of parcels are weighted averages.
d) Assumes groundwater basin in Snake Mountains is full, and inflow equals outflow; in Toano Draw estimates based on Maxey-Eakin (1949) method for approximating recharge as percentage of precipitation and assumes groundwater basin would be drawn down by project water uses.
e) Estimates based on data and analyses indicating runoff to Thousand Springs Creek from Snake Mountains averages about 180 ac-ft/yr/sq mi and from the balance of the basin about 5 ac-ft/yr/sq mi.

4.5.2.2 Precipitation

The variability of storm size and temporal distribution within the study area is high. The average monthly precipitation is affected by the number, intensity, size, and distribution of storms.

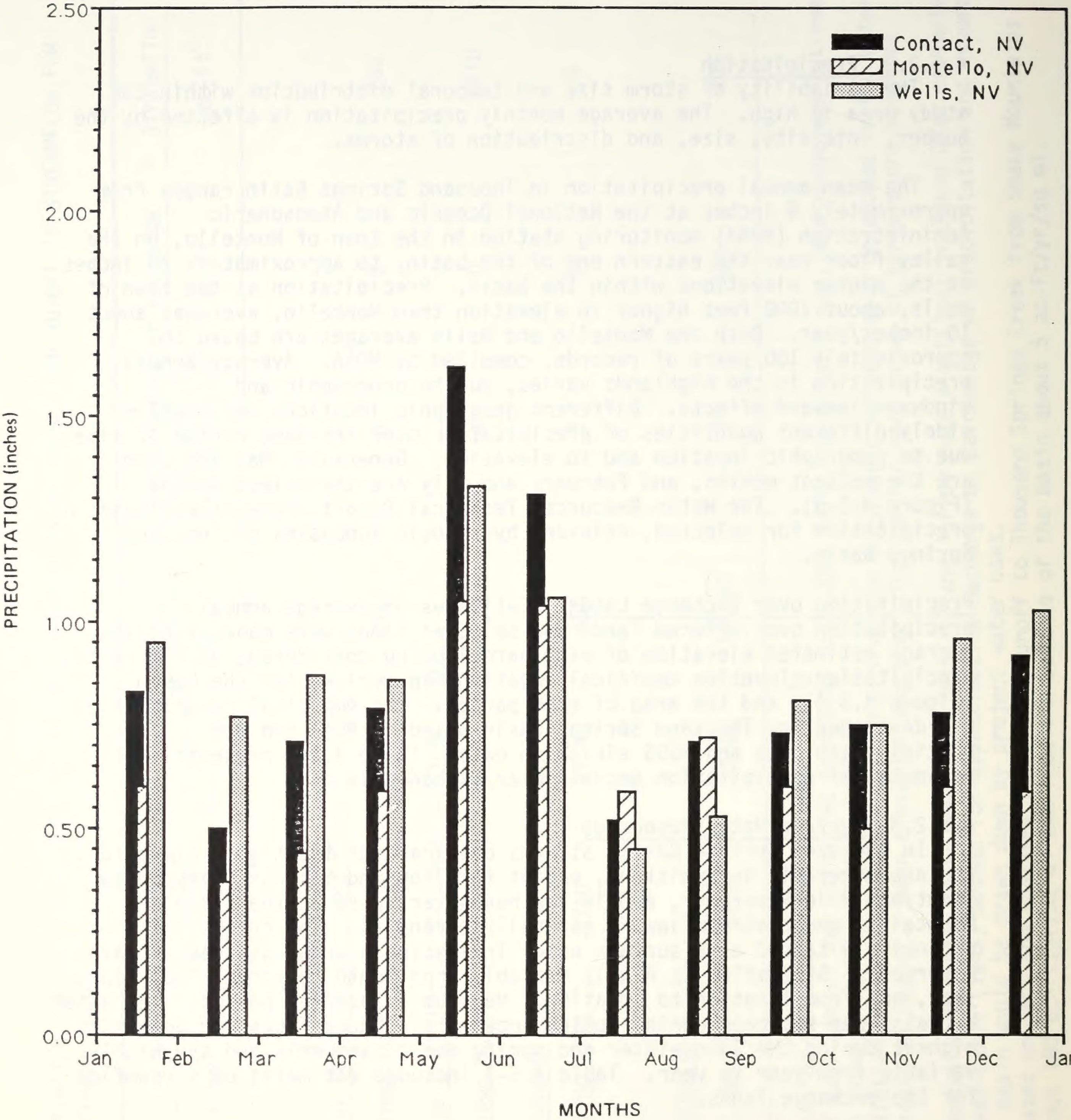
The mean annual precipitation in Thousand Springs Basin ranges from approximately 8 inches at the National Oceanic and Atmospheric Administration (NOAA) monitoring station in the town of Montello, on the valley floor near the eastern end of the basin, to approximately 20 inches at the higher elevations within the basin. Precipitation at the town of Wells, about 1000 feet higher in elevation than Montello, averages about 10 inches/year. Both the Montello and Wells averages are based on approximately 100 years of records, compiled by NOAA. Average annual precipitation in the highlands varies, due to orographic and windward/leeward effects. Different geographic locations may receive widely different quantities of precipitation over the same period of time, due to geographic location and to elevation. Generally, May and June are the wettest months, and February and July are the driest months (Figure 4.5-3). The Water Resources Technical Report presents estimates of precipitation for selected, relevant hydrologic subbasins of Thousand Springs Basin.

Precipitation over Exchange Lands. Estimates of average annual precipitation over offered lands and selected lands were made using the average estimated elevation of each parcel being considered, utilizing the precipitation-elevation empirical relationship derived for the basin (Figure 4.5-4), and the area of each parcel. The empirical relationship was developed for Thousand Springs Basin based on NOAA and BLM precipitation data and USGS elevation data. Table 4.5-2 presents the estimates of precipitation amounts over exchange lands.

4.5.2.3 Surface Water Resources

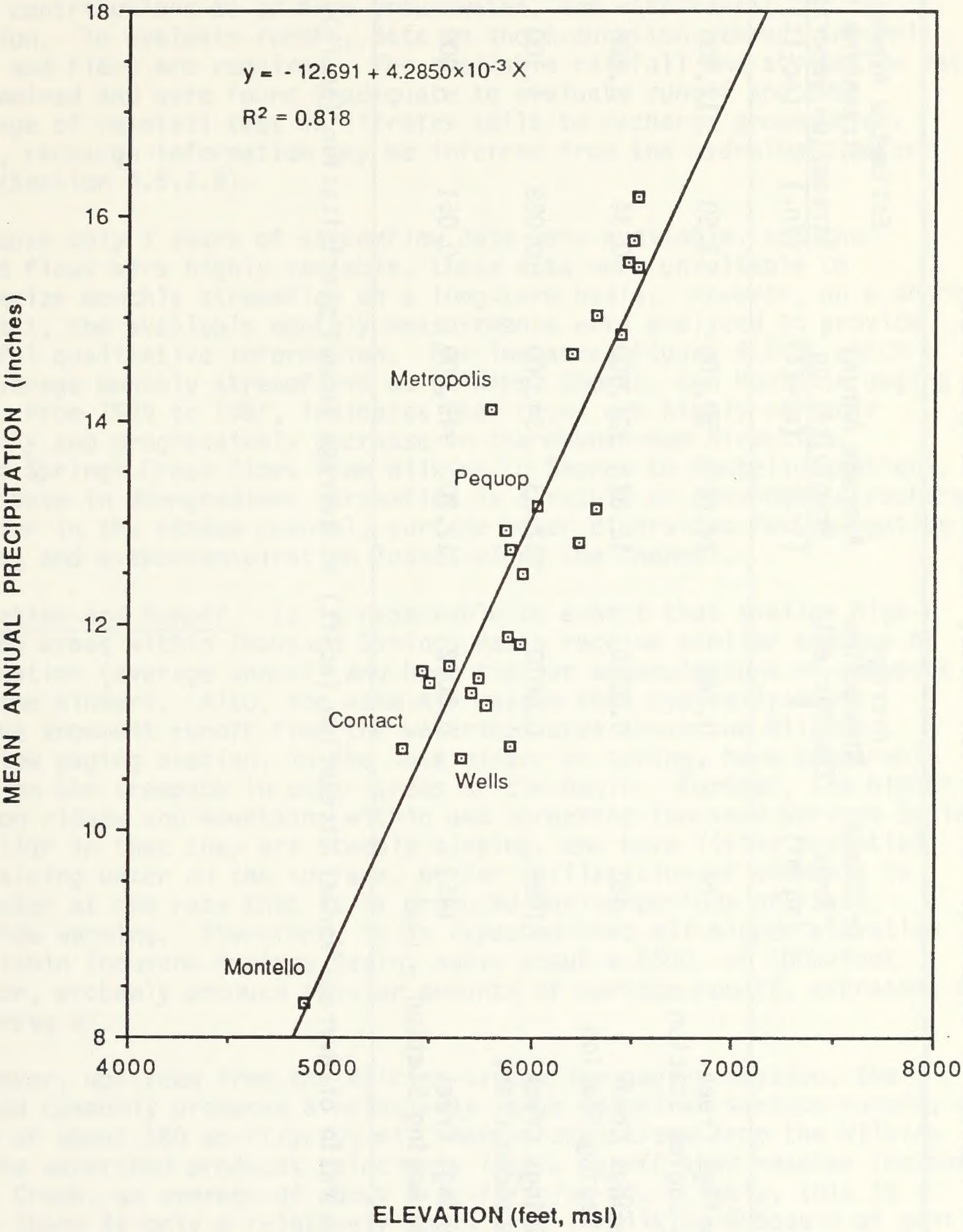
In Thousand Springs Basin, streams originate at the higher elevations and are generally intermittent, except for Thousand Springs Creek below Twentyone Mile Reservoir, and in the headwaters area in the Snake Mountains, where streamflow is generally perennial. The creek is extensively tapped as a surface water irrigation source upstream of Dake Reservoir. Streamflow is highly variable from month to month, from year to year, and from location to location. Maximum streamflow periods are caused by rain over snowpack during spring snowmelts. Streamflows are generally highest during the late winter and spring due to snowmelt and are highly variable from year to year. Table 4.5-2 includes estimates of streamflow for the exchange lands.

Streamflow. The results of the streamflow generation model for the Thousand Springs Creek are shown in Table 4.5-3. The computed estimates of average annual streamflows were 17 and 5.5 cubic feet per second (cfs) at the Wilkins and Montello gaging stations, respectively. When distributed over the respective drainage areas, estimated average annual streamflows are 3.5 and 0.051 inches of areawide runoff at the same two locations.



Source: National Oceanic and Atmospheric Administration 1949-1983.

Figure 4.5-3. AVERAGE MONTHLY PRECIPITATION AT CONTACT, MONTELLO, AND WELLS MONITORING STATIONS, 1949-1983



Source: Bureau of Land Management 1983 and National Oceanic and Atmospheric Administration 1949-1980 for raw data.

Figure 4.5-4. MEAN ANNUAL PRECIPITATION VERSUS ELEVATION AT NOAA AND BLM STATIONS, 1963-1980

Table 4.5-3. RESULTS OF STREAMFLOW GENERATION MODEL, THOUSAND SPRINGS CREEK

Location	Drainage Area (sq mi)	Average Streamflow Coefficient* $\overline{K}$	Average Annual Precipitation (in.)	Average Annual Precipitation (ac-ft)	Estimated Average Annual Streamflow from Streamflow Generation Model (in.)	Estimated Average Annual Streamflow from Streamflow Generation Model (ac-ft)	Estimated Average Annual Streamflow from Streamflow Generation Model (cfs)
Thousand Springs Creek at Wilkins Gaging Station	68	0.246	14.08	50,700	3.50	12,500	17.0
Thousand Springs Creek at Shores Gaging Station	483	0.0270	12.67	327,000	0.34	8,800	12.0
Thousand Springs Creek below Crittenden Creek	1089	0.0070	12.63	734,000	0.088	5,100	7.1
Thousand Springs Creek at Montello Gaging Station	1453	0.0042	12.20	945,000	0.051	4,000	5.5

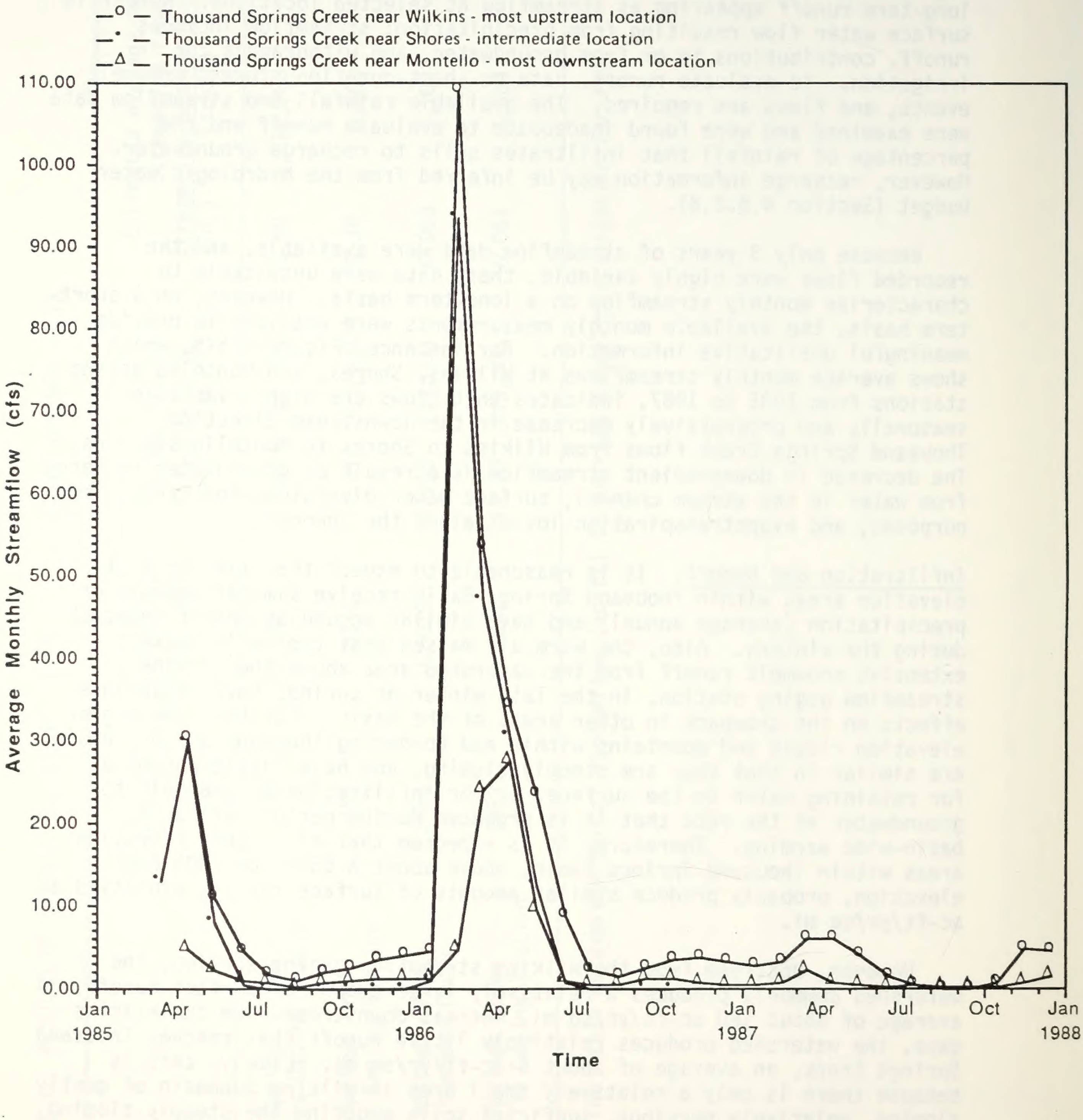
* $\overline{K}$ is the ratio of average annual streamflow (ac-ft) to average annual precipitation (ac-ft).

This analysis did not evaluate instantaneous runoff but rather evaluated long-term runoff appearing as streamflow at selected locations. Runoff is surface water flow resulting from precipitation; streamflow includes runoff, contributions to or from groundwater, and withdrawals for irrigation. To evaluate runoff, data on short-duration storms, snowmelt events, and flows are required. The available rainfall and streamflow data were examined and were found inadequate to evaluate runoff and the percentage of rainfall that infiltrates soils to recharge groundwater. However, recharge information may be inferred from the hydrologic water budget (Section 4.5.2.8).

Because only 3 years of streamflow data were available, and the recorded flows were highly variable, these data were unsuitable to characterize monthly streamflow on a long-term basis. However, on a short-term basis, the available monthly measurements were analyzed to provide meaningful qualitative information. For instance, Figure 4.5-5, which shows average monthly streamflows at Wilkins, Shores, and Montello gaging stations from 1985 to 1987, indicates that flows are highly variable seasonally and progressively decrease in the downstream direction. Thousand Springs Creek flows from Wilkins to Shores to Montello stations. The decrease in downgradient streamflow is a result of groundwater recharge from water in the stream channel, surface water diversions for irrigation purposes, and evapotranspiration losses along the channel.

Infiltration and Runoff. It is reasonable to expect that similar high-elevation areas within Thousand Springs Basin receive similar amounts of precipitation (average annual) and have similar accumulations of snowpack during the winters. Also, the warm air masses that typically cause extensive snowmelt runoff from the watershed area above the Wilkins streamflow gaging station, in the late winter or spring, have comparable effects on the snowpack in other areas of the basin. Further, the higher elevation ridges and mountains within and bordering Thousand Springs Basin are similar in that they are steeply sloping, and have little potential for retaining water on the surface, or for infiltration of snowmelt to groundwater at the rate that it is produced during periods of rapid, basin-wide warming. Therefore, it is expected that all higher elevation areas within Thousand Springs Basin, above about a 6500- or 7000-foot elevation, probably produce similar amounts of surface runoff, expressed as ac-ft/yr/sq mi.

However, upstream from the Wilkins streamflow gaging station, the watershed commonly produces a relatively large amount of surface runoff, an average of about 180 ac-ft/yr/sq mi, whereas downstream from the Wilkins gage, the watershed produces relatively little runoff that reaches Thousand Springs Creek, an average of about 5 ac-ft/yr/sq mi. Likely, this is because there is only a relatively small area in Wilkins Subbasin of gently sloping, relatively pervious, surficial soils abutting the steeply sloping, higher elevation areas. Thus, there is relatively little loss of runoff by infiltration to groundwater as the snowmelt from higher areas flows overland towards the creek and down the creek channel.



Source: United States Geological Survey 1988a.

Figure 4.5-5. AVERAGE MONTHLY STREAMFLOW AT WILKINS, SHORES, AND MONTELLO GAGING STATIONS, 1985-1987

In contrast to Wilkins Subbasin, all other higher elevation ridges and mountains, within and bordering Thousand Springs Basin, are separated from Thousand Springs Creek by extensive areas of gently sloping lands underlain by alluvial sediments that permit relatively high rates of infiltration. Therefore, relatively little of the runoff from those higher elevation areas reaches Thousand Springs Creek.

Flooding. Information on flooding or peak flow conditions in the study area is scarce. However, WCC estimated the 100-year flood peak discharge at three locations in Thousand Springs Basin, utilizing a method developed by Christensen and Spahr (1980). These estimates are 1600 cfs in Toano Draw near Toano Well No. 2, 2300 cfs in Toano Draw near Toano Well No. 1, and 2200 cfs in Thousand Springs Creek near Winecup Ranch.

4.5.2.4 Groundwater Resources

The water-bearing properties of the geologic units that may be affected by the proposed action are described in this section.

Alluvial Aquifer. The relatively coarse-grained, unconsolidated alluvial channel deposits, which are present within the central portions of the valleys and along the ephemeral streams, comprise the alluvial aquifer. This aquifer is the principal groundwater bearing unit within Toano Draw Subbasin, along Thousand Springs Creek, and within Montello Valley. It consists of a heterogeneous mixture of stream-deposited sand and gravel, with interbedded silt and clay deposits. The permeability of these alluvial channel deposits is related primarily to the grain size and degree of sorting of the grains during deposition. In general, the permeability is higher in the more well-sorted coarse-grained channel deposits. Typically, the deposits having a higher degree of sorting occur in the central portion of such a basin because the streams depositing these sediments would have had relatively low gradients in this area as compared to the higher gradients of those stream reaches along the mountain front margins of the basin.

Alluvial Fan - Volcaniclastic Aquitard. The fine-grained, alluvial fan, lake and volcaniclastic sediments that have been deposited along the mountain fronts, on the margins of the valleys, constitute the alluvial volcaniclastic aquitard. This aquitard is characterized as being of great thickness and consisting generally of silt and clay. This unit also contains variable amounts of sand, gravel, cobbles, and volcanic ash. These generally fine-grained sediments occur adjacent to and extend beneath the alluvial aquifer unit in Toano Draw Subbasin. This unit is generally not capable of yielding large flow rates of water to wells because of its relatively low hydraulic conductivity as compared to the alluvial aquifer. However, on a large scale, this unit contains large volumes of water in storage because of its substantial effective porosity. Also, on a large scale, this unit is capable of transmitting substantial amounts of groundwater into the alluvial aquifer.

Paleozoic Carbonate Aquifer. Consolidated carbonate rock formations of Paleozoic Age are exposed in the mountain ranges that form the margins of the subbasins within Thousand Springs Basin. It is believed that they are generally continuous between the ranges, although typically covered by great thicknesses of alluvial valley infill materials. Beneath Toano Draw Subbasin, the extent, distribution, and hydraulic properties of this formation are not well-defined because of the great depth at which it occurs. However, significant secondary porosity features, including vugular and cavernous openings along fractures, have been observed in outcrops of these rocks along the northeastern margin of Toano Draw Subbasin and in Gamble Range. From observation of these features it may be inferred that this unit probably has a high capacity for transmitting groundwater regionally, particularly along deep flow lines. This may account for deep groundwater movement out of the Toano Draw Subbasin, as discussed by Rush (1968). Rush noted that many areas of eastern Nevada are underlain by carbonate rocks that convey groundwater beneath and between valleys and supply water to large springs. Regional groundwater flow through these carbonate rocks has also been discussed by Maxey (1968).

Definition of Alluvial Aquifer Thickness and Extent. In Toano Draw, the thickest portion of the alluvial aquifer is generally along the central axis of the subbasin. Based on data from water and exploratory petroleum well logs, geologic reconnaissance, and geophysical exploration, the thickness of this alluvium varies from less than 50 feet, near the margins of Toano Draw Subbasin, to greater than 800 feet near the center of the subbasin. The alluvium is bounded by faults to the east, west, and southeast margins of the subbasin. Along Thousand Springs Creek, the alluvial aquifer varies in thickness from approximately 900 feet, in the area north of Toano Draw, to less than about 100 feet in the vicinity of Eccles Narrows. In the Gamble Ranch area, the alluvial aquifer appears to range in thickness from about 100 feet, along Thousand Springs Creek near the confluence of Crittenden Creek, to about 700 feet in the central portion of Tecoma Valley near Dake Reservoir.

Groundwater Flow System. Groundwater flow systems in the project vicinity may be described in three general categories, according to scale: regional, intermediate, and local. Flow path length and depth increase with the increasing areal scale of the flow system. Recharge areas for regional systems lie within the mountainous areas having the highest topographic elevation present within the regional watershed. Discharge areas for regional flow systems are in the topographically depressed areas (lower elevations) of the same large-scale watershed in which the recharge area flow lines originate. Typically, the springs that are regional discharge points have large flow rates, relatively high temperature, and little seasonal fluctuation in flow rate (Maxey 1968). Local groundwater systems are characterized by short flow paths and typically underlie small watersheds and contain flow lines that extend only to shallow depths. These local flow systems usually have spring discharge points with water of relatively low temperature and large seasonal fluctuations in flow rate (Maxey 1968). Intermediate-scale groundwater systems have characteristics that are between those of regional and local systems.

In the study area, the regional groundwater flow system extends from a recharge area in the Snake Mountains, on the west of Thousand Springs Basin, to the discharge area that is within Montello Valley and points further east. Several flow systems of intermediate scale, such as the flow system of Toano Draw Subbasin, are superimposed on this regional flow system. Examples of local flow systems include those underlying the watersheds of Deadman Creek, Hunter Draw, and Immigrant Creek. The boundaries of, and flow directions within, these flow systems have been characterized in this study, with emphasis on Toano Draw Subbasin, based on several lines of hydrogeological evidence. These include the analysis of groundwater level data, distribution of hydraulic head data, and the configuration of the water table, as described below.

Groundwater Data. Information on wells and springs in the Basin was compiled from files of the BLM, USGS, and the Office of Nevada State Engineer. In addition, field surveys of wells and springs were conducted by WCC personnel. Well descriptions and water level measurements were collected by WCC from August 1988 through February 1989. These groundwater level measurements are provided in the detailed tabulation of well and spring characteristics included in Appendix I of Water Resources Technical Report (WCC 1989). The water level measurements taken by WCC included 41 existing wells, 2 existing piezometers, and 12 monitoring wells and test wells installed by WCC during the summer and fall of 1988. These data are supplemented by well measurements provided by the USGS (USGS 1988b), Guyton (1982), Gabbay (1987), and Rush (1968).

Groundwater Flow. The elevation and configuration of the water table were mapped in the areas of Toano Draw Subbasin, Thousand Springs Creek, and Montello Valley (Figure 4-5 of the Water Resources Technical Report). The water table surface conforms to topography and drainage basin morphology. Groundwater flow divides are present beneath topographic divides. That is, in areas underlying topographic ridges, the water table is elevated with and reflective of the topography. Conversely, the water table forms trough-like depressions, reflecting topography, in areas underlying the valleys.

In Toano Draw Subbasin, flow is generally convergent toward Toano Draw from the Pequop Mountains, Windermere Hills, and the Gamble Range. In the alluvial aquifer, in the central portion of Toano Draw, the flow direction is generally northward, in general accord with the topographic slope. Within the intermediate-scale Toano Draw flow system, it is reasonable to assume that there is a significant downward component of flow in the topographically elevated areas surrounding the subbasin, and an upward component of flow in the topographically depressed areas in the northern end of the subbasin near Thousand Springs Creek. This description of the flow system is consistent with the flow model described by Maxey (1968) and Toth (1963).

On a regional scale, the groundwater flow directions are influenced by the large scale topographic relief. Flow paths in the regional flow system

of Thousand Springs Basin probably originate in the higher elevations of the Snake and Pequop mountains, west and south, respectively, of Thousand Springs Basin, following the model described by Maxey (1968) and Toth (1963). In these recharge areas flow lines would have a steep downward component. Areally, flow would be generally eastward toward the lower-elevation discharge areas lying in the eastern Montello Valley and points further east in Great Salt Lake Basin. In these discharge areas there is a significant upward component in the flow paths, as evidenced by the deeper irrigation wells which have been observed to be under artesian conditions in the Montello area.

Hydraulic Characteristics. The hydraulic characteristics of unconsolidated sediments in Toano Draw Subbasin were estimated from the results of six constant rate aquifer pumping tests performed at test well locations TW-1, TW-3, TW-12, TW-14, TW-15, and the pre-existing irrigation well, 41-65-35ad (Figure 4-1 of the Water Resources Technical Report). Duration of five of the tests ranged from 8 hours to 48 hours each. The long-term test, conducted in Well 41-65-35ad, which is located approximately 100 feet east of Well MW-17, had a pumping duration of approximately 14 days. The data from these tests were used in conjunction with aquifer test data reported by others as input to the groundwater flow modeling that is described in the Water Resources Technical Report). Results of the modeling were used to assess the potential environmental impacts of different options for developing the water resource as required for the project (Section 5.5.1).

Transmissivity values (the rate at which water is transmitted through a unit width of aquifer under a unit hydraulic gradient) estimated from these tests range from approximately 2000 gallons per day per foot (gpd/ft) to 50,000 gpd/ft. The lowest transmissivity was observed at the TW-3 well location, and the highest transmissivities were observed at Wells TW-15 and 41-65-35ad. The hydraulic conductivity values estimated from these tests range from approximately 4.1 to 56 feet/day, with the mean value being about 18 feet/day. This wide range of values reflects the locally variable hydraulic properties of the heterogeneous unconsolidated sediments in Toano Draw. The values of storage coefficient (or storativity, which is the volume of water that an aquifer releases or stores per unit surface area of aquifer and change in head), calculated from the drawdown data, and the averages of the data from each of the observation wells, range from approximately 1.3×10^{-3} to 1.2×10^{-4}. The calculated storativities from the aquifer tests in Toano Draw are indicative of semi-confined conditions. However, the specific yield of the aquifer, which would be relevant to long-term pumping, would be much higher than the storativities calculated from these pumping tests. The specific yield of this aquifer is estimated to range from approximately 10 to 20 percent.

4.5.2.5 Water Quality

Groundwater and spring water chemical analyses results have been published in reports of several studies conducted in Thousand Springs Basin. Rush (1968) conducted a water-resources appraisal of Thousand Springs Valley and analyzed major cations and anions in water samples

collected from several spring and domestic wells. In the Toano-Rock Spring area, Well 38-66-24d on 6-22-67 was sampled. Water from this well had a near neutral pH (7.8); dissolved species were predominantly calcium and bicarbonate, and it had relatively low total dissolved solids (TDS <500 mg/L). The three surface water samples collected from Thousand Springs and Rock Springs creeks in the area had a similar pH but had a variable TDS and sodium was the dominant cation in some cases. Rush (1968) sampled Crittenden Spring in 1967 and found it had a pH of 8.01, low TDS, and was predominantly calcium-magnesium bicarbonate. Guyton (1982) recompiled the hydrochemical data of Rush (1968) and sampled and analyzed water from 15 wells and one spring in the study area. The Guyton data indicate that the groundwater is primarily a calcium-bicarbonate type with low TDS and a near neutral pH.

WCC conducted a sampling and analysis program of water from 15 springs and 13 wells in the vicinity of Toano Draw Subbasin to better characterize the water quality. The sampling locations are listed in Table 5-1 and shown on Figure 5-1 of the Water Resources Technical Report.

Areal Trends in Groundwater Quality. Samples show that calcium and bicarbonate (reported as alkalinity) are the dominant cation and anion, respectively (Water Resource Technical Report, Table 5-1). In several cases (MW-1, MW-2, MW-4, and Well 40-65-10) sodium is the dominant cation. The cation dominance of sodium relative to calcium may result from increased residence time and reaction between the groundwater and the aquifer material. Trends in several hydrochemical constituents reflect the generally northward groundwater flow path that exists within the central portion of Toano Draw Subbasin. Wells TW-14, TW-15, TW-3, Toano No. 1, 40-65-10, and MW-4 are located along a line that is generally parallel to and along this flow path. Wells TW-14, TW-15, and TW-3 are located in areas of the subbasin that contain relatively younger water of a calcium bicarbonate type. As contact time increases, i.e., with increasing distance along this flow path, the sodium concentration in the water increases from 15 to greater than 50 mg/L and surpasses calcium. The modified water composition is apparent in the data from downgradient wells, MW-4 and 40-65-10. This trend is probably a result of the higher solubility of sodium minerals, and the exchange of dissolved calcium for sodium adsorbed on the clay surfaces. The dissolved sulfate also increases with distance along this flow path but does not surpass the bicarbonate concentration.

The areal trends in chloride, TDS, and silica (SiO_2) concentrations in groundwater and spring water provide useful information on groundwater recharge characteristics and chemical reactivity of the aquifer materials. Areal plots of the TDS and chloride concentrations in Toano Draw and the surrounding highlands show a noticeable distribution of low values in the south-central portion of the draw and higher levels in the northern portion of the draw near Thousand Springs Creek (Figures 5-3 and 5-4 of the Water Resources Technical Report. This pattern supports the hypothesis that substantial recharge occurs from surface waters flowing

onto the valley floor in the southern and possibly south central portions of Toano Draw, and that relatively fresh water moves relatively rapidly within the shallow portions of the alluvial aquifer in the draw, northward toward Thousand Springs Creek. The relatively low chloride and TDS values of the aquifer in the southern-central part of Toano Draw, compared to values in the nearby highlands, suggest rapid flushing and short residence time for this water. The higher concentrations in the uplands surrounding the subbasin may be a result of longer residence times (contact time between water and rock), slower flow velocities, and less flushing along these flow paths.

The sulfur odor detected in the artesian water produced from the lower portion of the MW-1 boring may indicate that the deep groundwater has had a long-residence time along a deep regional flow line. High SiO_2 concentrations of 60 to 70 mg/L are probably a result of the high reactivity of the volcanic glasses in the sediments that allow for rapid dissolution of SiO_2-containing phases (Figure 5-2, Water Resources Technical Report).

4.5.2.6 Water Use

In Thousand Springs Basin and the Snake Mountains study area, there is, and has historically been, relatively little water development and use when considered in relation to the total available water resources. Groundwater in Thousand Springs Basin is used for domestic and municipal supplies, livestock and wildlife, and irrigated agriculture. Surface water, including springs, is used in the basin for recreation, livestock and wildlife, and irrigated agriculture. There is currently no identified groundwater or surface water use associated with oil or gas production, mining, or manufacturing activities in the basin. Current groundwater use is largely restricted to the alluvial aquifer.

Surface water reservoirs in Thousand Springs Basin are privately owned and used for various purposes. Twentyone Mile Reservoir (owned by Lands of Sierra, Inc.) is an irrigation reservoir with some flood control and recreational use. Crittenden Reservoir (owned by Lands of Sierra, Inc.) is an irrigation reservoir with some recreational use. Dake Reservoir (owned by Lands of Sierra, Inc. and other private owners) is a recreational reservoir, used primarily for fishing. Average evaporation losses from the three reservoirs is estimated to be about 2000 ac-ft/yr, based on an estimated average water surface area of about 600 acres and evaporation of about 3.5 ft/yr.

Generally, livestock obtain water primarily from wells, and wildlife obtain water primarily from creeks, springs, reservoirs, and ponds. A conservative estimate of livestock and wildlife water use is less than 200 ac-ft/yr. This assumption is based on the following three assumptions: estimates of big-game use (wildlife) in the area, 10,000 cattle within Thousand Springs Basin, and 15 gallons/cow/day.

In 1988 to 1989, the Elko Nevada offices of the SCS conducted site reconnaissances of irrigated agricultural practices in Thousand Springs Basin. The SCS provided data on irrigated acreage by the type of crop, source of water, and location along Thousand Springs Creek. They provided estimates of the consumptive use of water for each type of crop, and the efficiency of water application. They noted that the amount of water applied in any year would be related to the availability of water from Thousand Springs Creek because much of the irrigated land did not have an alternate source--i.e., groundwater from wells was not available. WCC analyzed the data provided by the SCS, and from those data developed estimates of total net irrigation use of water and total water that would be diverted from Thousand Springs Creek in a year with average annual flow, and also the amount of groundwater that would be pumped under average runoff conditions. Those estimates are summarized in Table 4.5-4. It is noted that the total amount of water diverted from Thousand Springs Creek, as indicated in the table, exceeds the total average flow in the creek. This is because some tailwater, from irrigation along the upstream reaches of the creek, returns to the creek and is available for reuse, and therefore, in these estimates some water is counted more than once. Ultimately, most of the diverted water is either consumptively used or infiltrates to groundwater.

Phreatophytes along Thousand Springs Creek transpire water directly from the water table. Rush, in 1968, estimated this consumptive use of water to be about 5700 ac-ft/yr. This is considered a conservative estimate for present conditions and is used in the following hydrology budget analysis.

4.5.2.7 Hydrologic Budget

The hydrologic budget for Thousand Springs Basin and Toano Draw are summarized in this section. The estimates are based on the analyses and assumptions presented in the Water Resources Technical Report.

Thousand Springs Basin. The water resources of Thousand Springs Basin are derived from precipitation falling within the watershed boundary of the basin. An average annual hydrologic budget estimate for the basin was developed to estimate groundwater recharge within the watershed (Table 4.5-5) and the groundwater outflow from the basin that moves eastward into Great Salt Lake Basin. The important hydrologic factors are illustrated schematically on Figure 4.5-6.

The hydrologic budget for Thousand Springs Basin included an estimated average of 945,000 ac-ft/yr of precipitation as the inflow to the watershed. The estimated average annual water losses from the watershed land surface were 851,000 ac-ft of local evapotranspiration (i.e., evapotranspiration that occurs essentially where the precipitation falls), 15,000 ac-ft of net irrigation, 4000 ac-ft of streamflow discharging to Utah, 6000 ac-ft phreatophyte evapotranspiration, 2000 ac-ft reservoir evaporation, and 61,000 ac-ft of groundwater recharge, with 8000 ac-ft of contributions from groundwater applied for irrigation. This water budget

Table 4.5-4 ESTIMATED IRRIGATION WATER USE BY SUBBASINS, THOUSAND SPRINGS BASIN

Subbasin and Type of Use	Area (ac)	Net Water Use (ac-ft/ac)	Net Water Use (ac-ft)	Application Efficiency (Percent)	Water Applied (ac-ft)	Water Source
I. Montello-Crittenden						
A. Native Pasture						
Rocky Ford No. 4	108	1.43	154	30	513	Thousand Springs Creek
Upper Gamble No. 3	254	1.43	363	30	1210	Thousand Springs Creek
Dake & Warm Springs	1000	1.91	1910	30	6367	Thousand Springs Creek[a]
	1362		2427		8090	
B. Improved Pasture						
Crittenden Nos. 6-8	107	1.53	164	50	328	Thousand Springs Creek
Gamble Ranch Nos. 1,2	743	1.53	1137	50	2274	Thousand Springs Creek
	850		1301		2602	
C. Alfalfa Haylands						
Gamble Farm Nos. 1-18	1448	2.21	3200	50	6400	Wells
Twelvemile No. 19	68	2.21	150	50	300	Spring
Twelvemile Nos. 21-23	434	2.21	959	50	1918	Wells
Twelvemile Nos. 24,25	63	2.21	139	50	278	Crittenden Reservoir
	2013		4448		8896	
Subtotal	4225		8176		19,588	
II. Rocky Butte						
A. Native Pasture						
Twentyone Mile Pasture	187	0.95	178	30	593	Thousand Springs Creek
Eighteen Mile No. 11	236	0.95	224	30	747	Thousand Springs Creek
Eighteen Mile No. 16	433	0.95	411	30	1370	Thousand Springs Creek
Eccles No. 10	856		813		2710	

Table 4.5-4 ESTIMATED IRRIGATION WATER USE BY SUBBASINS, THOUSAND SPRINGS BASIN (concluded)

Subbasin and Type of Use	Area (ac)	Net Water Use (ac-ft/ac)	Net Water Use (ac-ft)	Application Efficiency (Percent)	Water Applied (ac-ft)	Water Source
B. Improved Pasture						
Eighteen Mile Nos. 12-15	304	1.53	465	50	930	Thousand Springs Creek
Subtotal	1160		1278		3640	
III. Toano-Rock Spring[b]						
A. Native Pasture						
Ninemile Nos. 8,9	614	0.95	583	30	1943	Thousand Springs Creek
B. Improved Pasture						
Winecup Nos. 4-7	1086	2.04	2216	50	4432	Thousand Springs Creek
Subtotal	1700		2799		6375	
IV. Herrell Siding - Brush Creek						
A. Improved Pasture						
Brush Creek	349	2.04	712	50	1424	Brush Creek
Winecup Nos. 1-3	1105	2.04	2254	50	4508	Thousand Springs Creek
Subtotal	1454		2966		5932	
Subbasins I to IV						
TOTAL	8539		15,219		35,535	

Source: Data provided or derived from SCS, 1988-1989. Subbasin designations adopted from Rush 1968. Net water use (ac-ft) and water applied (ac-ft) derived by WCC.

a Includes subirrigation by shallow groundwater.

b Native and improved pastures are on both sides of Thousand Springs Creek floodplain, and in both Toano Creek and Rock Spring Creek Subbasins.

Table 4.5-5 HYDROLOGIC BUDGET, THOUSAND SPRINGS BASIN AND TOANO DRAW SUBBASIN

Drainage Area/ Average Annual Parameter of Hydrologic Budget	Thousand Springs Basin	Toano Draw Subbasin
Drainage Area (sq mi)	1453	252
Precipitation	945,000	171,000
Local Evapotranspiration[a]	851,000	154,000
Phreatophyte Evapotranspiration	6,000	0
Streamflow	4,000	1,000
Net Irrigation	15,000	0
Groundwater Applied	8,000	0
Irrigation Return	20,000	0
Groundwater Recharge	61,000	16,000
Maxey-Eakin[b]	61,000	12,000
Groundwater Outflow	67,000	16,000
Darcian Flow Calculation Estimate (Appendix J, Water Resources Technical Report)	30,000	6,100

Numerical values estimated by WCC.

All hydrologic budget parameters indicated in ac-ft/yr except drainage area in sq mi.

[a] Assumes local evapotranspiration is 90 percent of precipitation. (For conservatism, if local evapotranspiration were assumed equal to 93 percent of precipitation, or about 879,000 ac-ft/yr, then the groundwater recharge would equal about 33,000 ac-ft/yr and groundwater outflow would equal about 39,000 ac-ft/yr.

[b] Estimate based on applying Maxey-Eakin method (Watson et al. 1976).

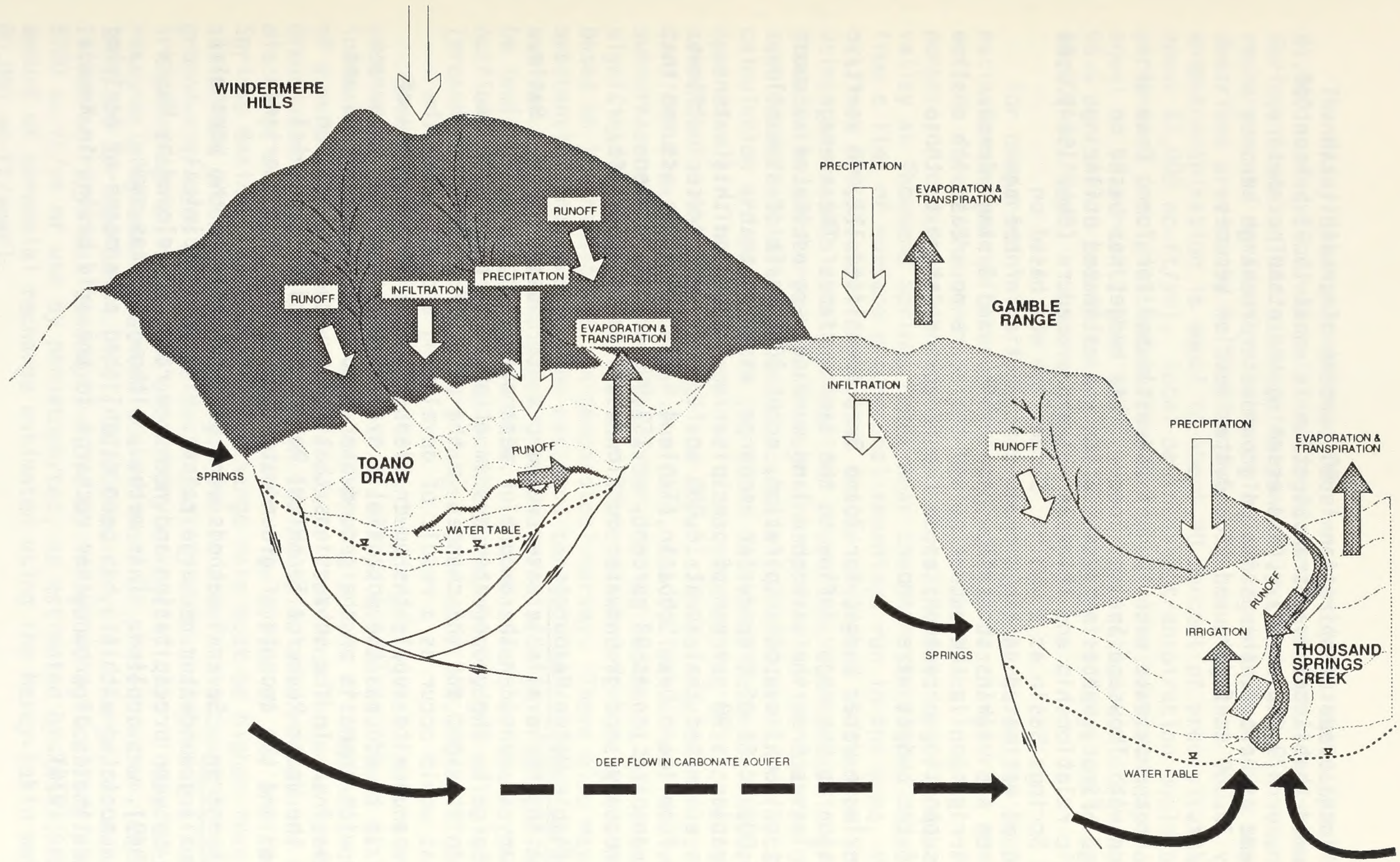


Figure 4.5-6. SCHEMATIC OF HYDROLOGIC CYCLE THOUSAND SPRINGS BASIN

assumes that local evapotranspiration is 90 percent of precipitation. If it is assumed that local evapotranspiration is equal to 93 percent of precipitation, or 879,000 ac-ft/yr, and assuming the other parameters remain the same as before, the estimated groundwater recharge becomes approximately 33,000 ac-ft/yr, and groundwater outflow becomes 39,000 ac-ft/yr.

Toano Draw. An approximate water budget was estimated for Toano Draw at the confluence with Thousand Springs Creek. This budget was based on the following. First, subbasin precipitation was estimated utilizing the orographic relationship and Thiessen polygon procedure (Chow 1964) used for Thousand Springs Basin as a whole. Streamflow was based on 5 ac-ft/yr/sq mi estimated as the average contribution of the basin downstream from the Wilkins streamflow gage to Thousand Springs Creek. There is no irrigation in the subbasin, and there are no areas with shallow groundwater supporting phreatophytes so the factors relating to those components of the budget were zero.

The approximate water budget for Toano Draw identified 171,000 ac-ft/yr of precipitation as the major inflow to the land surface. The average annual water losses from the watershed land surface were estimated as about 154,000 ac-ft of local evapotranspiration, about 1000 ac-ft of streamflow, and about 16,000 ac-ft of groundwater recharge, assuming that evapotranspiration is 90 percent of precipitation. Based on this water budget, it is estimated that about 16,000 ac-ft/yr of groundwater outflows as underflow from Toano Draw Subbasin (Table 4.5-5). If it is assumed that local evapotranspiration is 93 percent, or 159,000 ac-ft/yr, then groundwater recharge and groundwater outflow would be 11,000 ac-ft/yr.

4.5.2.8 Available Water Resources

In evaluating the available water resources of Thousand Springs Basin, it is necessary to consider the amount of perennial (long-term annual average) recharge to the groundwater system at present, the amount of groundwater in storage, and the changes in the rates of recharge and discharge that would occur as a result of developing and utilizing the groundwater resource to supply the power plant project. The purpose of this section is to address the potentially available groundwater resources in the basin with emphasis on the groundwater resources of Toano Draw and Montello Subbasins. In the subsections that follow, the information contained in the Water Resource Technical Report regarding perennial recharge rates and the amounts of groundwater in storage is summarized.

Groundwater Recharge. Several methods were used to estimate the perennial (average annual) groundwater recharge rates. First, an empirical relationship between precipitation and recharge rates, developed by Maxey and Eakin (1949), was applied. This method, although it has some uncertainty associated with it, has been established as a means of deriving approximate estimates of groundwater recharge to the arid basins in Nevada (Watson et al. 1976).

The Maxey-Eakin method resulted in an estimate that approximately 61,000 ac-ft/yr of water is recharged to the groundwater system in Thousand Springs Basin. This estimate is generally consistent with the estimate of recharge rate derived by the hydrologic budget analyses for the Basin described previously in Section 4.5.2.7, assuming that local evapotranspiration is equal to about 90 percent of precipitation (i.e., about 67,000 ac-ft/yr). Total basin evapotranspiration would be about 92.5 percent of precipitation in that case. If local evapotranspiration were equal to 93 percent, then total evapotranspiration would be about 95.5 percent of precipitation and groundwater recharge would be about 40,000 ac-ft/yr.

For comparison with these estimates of recharge in the basin, an estimate was made of the current groundwater discharge rate through the eastern end of Thousand Springs Valley in the Montello area. For this purpose, a cross section was drawn across the most restrictive part of the valley at Thousand Springs Creek near the Utah stateline. Based on data from a line of surface geophysical soundings run in the area, the estimated outlines of the alluvial aquifer in the area were plotted on the section. Using the available data on aquifer properties and hydraulic gradient, the groundwater discharge rate through the upper alluvial aquifer of the cross section was estimated to be approximately 30,000 ac-ft/yr (details of this calculation are provided in the Water Resources Technical Report, Appendix J). The cross-sectional area assumed for this calculation accounts for the flow through the upper alluvial aquifer only; it does not consider flow through deeper aquifers, due to lack of definitive deep subsurface data. However, the water-bearing sediments may extend to significantly greater depths than those assumed for the above estimate, based on the results of the geophysical survey. There also may be substantial groundwater flow eastward through the regional carbonate rock aquifer. Thus, the estimated groundwater discharge of 30,000 ac-ft/yr may be less than the actual flow rate. In comparison, estimates of groundwater outflow from the basin, based on the hydrologic budget calculation (presented in Section 4.5.2.7) ranged from about 40,000 to 67,000 ac-ft/yr.

Even though there are significant hydrogeological factors of uncertainty in these groundwater discharge estimates, these estimates indicate that at present there are probably tens of thousands of ac-ft/yr of groundwater discharge from Nevada to Utah from Thousand Springs Basin. Groundwater flow eastward through the Montello area represents the discharge of the regional groundwater flow system of the entire Thousand Springs Basin. The perennial recharge rate must be higher than the subsurface groundwater discharge rate in order to account for consumptive groundwater uses within the basin (mainly evapotranspiration losses from irrigated agriculture, and phreatophyte vegetation). Thus, there is reasonable agreement between the estimate of present water losses from Thousand Springs Basin (i.e., 30,000 ac-ft/yr discharge, or more, plus 15,000 ac-ft/yr net consumptive use by irrigated agriculture plus 5700 ac-ft/yr of use by phreatophytes, as estimated by Rush 1968) and the amount of perennial recharge estimated using the Maxey-Eakin method (about 60,000 ac-ft/year).

The conclusion drawn from these several methods of estimating groundwater recharge and flow is that the long-term average groundwater recharge rate within Thousand Springs Basin is probably 60,000 ac-ft/yr. However, given the uncertainties inherent in this type of regional recharge assessment, it is conservative to assume that these estimates may have an error of up to 30 percent (about 20,000 ac-ft/yr).

Applying the Maxey-Eakin method to Toano Draw Subbasin, using available precipitation data and orographic relationships, the average annual subbasin groundwater recharge rate was estimated to be approximately 12,000 ac-ft/yr. In comparison, the hydrologic budget calculation, described in the previous section, indicated that perennial groundwater recharge within this subbasin watershed is about 16,000 ac-ft/yr.

A high rate of surface water infiltration to groundwater for the Toano Draw Subbasin is consistent with the trends noted in the hydrochemical data (Section 5.0 of the Water Resources Technical Report). The patterns of concentrations of chloride, TDS, and tritium indicate that recharge is occurring at a relatively rapid rate along the stream channels on the valley floor, particularly in those channels in the southern-central portion of the subbasin. Several wells in Toano Draw that are located near the recent alluvial channels were found to contain measurable tritium content, thus indicating that groundwater below the water table in these areas has received recharge from precipitation occurring within about the past 35 years.

By making several hydrogeological assumptions to simplify calculations, it is possible to use a third method to estimate the rates at which recharge water has migrated from the ground surface through the vadose zone to the water table in these areas. Using the available tritium data as an approximate indication of flow rates through the vadose zone, the estimated rates of recharge range from approximately 7600 to 13,000 ac-ft/yr (calculations and assumptions are provided in Appendix J of the Water Resources Technical Report). The upper end of this range of values is consistent with the range of recharge rates derived using the hydrologic budget analysis approach and also the recharge rate estimate based on the Maxey-Eakin method.

A fourth method of estimating the perennial recharge rate in Toano Draw Subbasin is based on available hydrogeological data regarding groundwater flow through the alluvial aquifer. By assuming that the perennial recharge rate of the subbasin is at least equal to the present steady-state groundwater discharge through the northern end of the subbasin, it is possible to estimate a "probable minimum" value for long-term perennial recharge rate to the subbasin. Using the basic groundwater flow equation that is known as Darcy's Law, and the available data for hydraulic properties of the aquifer in this area, the rate of groundwater flow northward through a representative section of the shallow alluvial aquifer is about 6100 ac-ft/yr.

The apparent discrepancy between the recharge rate estimate based on groundwater discharge from the northern end of the subbasin and the higher recharge rates estimated by the previously described approaches may be because there is substantial discharge from the subbasin, along deep flow lines through the Paleozoic carbonate aquifer, to the regional flow system. Such deep discharge through basement Paleozoic rocks would be consistent with the discussions of regional flow through the Paleozoic carbonate aquifer by Rush (1968) and Maxey (1968). It is also reasonable to expect that there may be groundwater flow leaving Toano Draw to the east beneath Twentyone Mile Draw. Such flow would not be accounted for in the flow estimate developed using the Darcy flow described above. Therefore, the actual perennial recharge rate probably is substantially higher than the flow through the selected cross section of the alluvial aquifer at the northern end of Toano Draw Subbasin.

A further method was pursued to assess the credibility of the various recharge estimates discussed above, for both Toano Draw Subbasin and Thousand Springs Basin. Streamflow measurements demonstrate that there generally is a relatively large amount of runoff, and much of it occurs during late winter and spring due to snowmelt, from the 68-square-mile subbasin above the Wilkins gage, i.e., an average of about 180 ac-ft/yr/sq mi, whereas there is relatively little runoff from the rest of the basin watershed that reaches Thousand Springs Creek, i.e., about 5 ac-ft/yr/sq mi. Much of the area in Wilkins Subbasin is steeply sloping, mountainous terrain, at relatively high elevations, and there is little gently sloping land, of a type that would be conducive to rapid infiltration rates, between the mountains and the Wilkins streamflow gage. In practically all other parts of the basin, the higher mountains, within and surrounding the basin are separated from Thousand Springs Creek by relatively large areas of gently sloping lands of a type that would be conducive to rapid infiltration rates. Therefore, it seems likely that other areas in Thousand Springs Basin located at the same elevations as the mountains in Wilkins Subbasin, which produce runoff that is measured at the Wilkins gage, are producing comparable amounts of runoff, per unit of area, as the higher elevation lands in Wilkins Subbasin. This runoff occurs during a season when evapotranspiration rates are relatively low, yet little of it flows into Thousand Springs Creek. Therefore, it appears likely that much of the runoff from those other, higher elevation lands in the basin probably infiltrates to groundwater as it flows across the gently sloping lands between the mountains and Thousand Springs Creek.

Quantification and comparison of area and precipitation above various elevations within the basin and subbasin should be indicative of the probable contribution to groundwater recharge that may be attributed to those higher elevation areas. For this purpose, it is noted that the Wilkins streamflow gage is located at an approximate elevation of 5750 feet. The drainage area above the gage is about 68 square miles, the estimated precipitation on the watershed above the gage is 50,600 ac-ft/yr, and runoff from the watershed above the gage averages about 12,600 ac-ft/yr, i.e., about 25 percent of precipitation. In Table 4.5-6,

Table 4.5-6 ESTIMATED AREAS AND PRECIPITATION ABOVE VARIOUS ELEVATIONS - THOUSAND SPRINGS BASIN AND TOANO DRAW AND WILKINS SUBBASINS

Contour	Area within Interval (square miles)			Cumulative Area: Thousand Springs Basin		Cumulative Area: Toano Draw Subbasin		Cumulative Area: Wilkins Gaging Sta. Subbasin		Total Average Annual Precipitation Within Interval (ac-ft)			Cumulative Total Average Annual Precipitation (ac-ft)		
Interval (meters)	Thousand Springs Basin	Toano Draw Subbasin	Wilkins Gaging Sta. Subbasin	Area sq. mi.	Percent of Total	Area sq. mi.	Percent of Total	Area sq. mi.	Percent of Total	Thousand Springs Basin	Toano Draw Subbasin	Wilkins Gaging Sta. Subbasin	Thousand Springs Basin	Toano Draw Subbasin	Wilkins Gaging Sta. Subbasin
2600-2720	0.1	--	--	0.1	.01	--	--	--	--	100	--	--	100	--	--
2580-2600	1.1	--	0.5	1.2	.09	--	--	0.5	0.7	1400	--	600	1500	--	600
2360-2480	5.1	1.0	1.3	10.4	.44	1.0	0.4	1.8	2.6	5700	1100	1400	7200	1100	2000
2240-2360	17.1	4.4	1.7	23.5	1.62	5.4	2.2	3.5	5.2	17,400	4400	1700	24,600	5500	3700
2120-2240	59.7	9.8	7.4	83.2	5.73	15.3	6.1	10.9	16.1	55,300	9000	6600	79,900	14,500	10,300
2000-2120	118.1	19.7	10.7	201.2	13.85	34.9	16.9	21.6	31.9	98,900	16,200	8600	178,800	30,700	18,900
1880-2000	240.1	52.7	25.3	441.4	30.4	87.7	34.8	46.9	69.1	179,100	38,800	18,100	357,900	69,500	37,000
1760-1880	419.4	103.8	20.7	860.7	59.3	191.4	76.1	67.7	99.7	277,000	67,600	13,500	634,900	137,100	50,500
1640-1760	353.4	60.1	0.2	1214.1	83.6	251.6	99.9	67.8	100	202,700	34,200	100	837,700	171,300	50,600
1520-1640	158.8	--	--	1372.9	94.6	251.6	100	67.8	100	76,700	10	--	914,400	171,300	50,800
1400-1520	79.8	--	--	1452.7	100	251.6	100	67.8	100	31,100	--	--	945,500	171,300	50,600

a tabulation of areas within and above various elevation zones (120 meters, or about 400 feet per zone) for Thousand Springs Basin and Toano Draw and Wilkins Subbasins, and also the estimated average annual precipitation within and above the indicated zones are presented. Examination of the data in the table reveals that the total precipitation above 6900 feet elevation in Wilkins Subbasin, i.e., 10,300 ac-ft/yr, is less than the total runoff from the subbasin, and therefore, it is concluded that higher elevation areas that produce runoff in that subbasin must extend below a 6900-foot elevation. Because total estimated precipitation above that elevation, for both Toano Draw Subbasin and Thousand Springs Basin as a whole, exceeds the maximum estimate of groundwater recharge within the respective areas developed by the other methods discussed above, it appears that those maximum estimates are credible, i.e., 16,000 ac-ft/yr for Toano Draw Subbasin and 67,000 ac-ft/yr for Thousand Springs Basin.

To summarize, the various estimates of groundwater recharge to Toano Draw Subbasin fall within the range of about 6000 to 16,000 ac-ft/yr, and for Thousand Springs Basin within the range of 30,000 to 67,000 ac-ft/yr. In addition, there are substantial (but unquantified) amounts of groundwater recharge to Toano Draw Subbasin along Thousand Springs Creek from the areas north of Toano Draw and from the Thousand Springs Creek watershed to the west of the subbasin. There are also substantial amounts of streamflow that are currently used for irrigation in these areas. Approximately, 5300 ac-ft/yr along the creek above the Shores streamflow gage, that would be made available for groundwater recharge and or maintenance of flow in the creek by curtailing and ultimately terminating irrigation uses. Similarly, irrigation uses downstream from Shores would be curtailed and ultimately terminated to offset power plant water uses from the Gamble Ranch area.

Groundwater Storage. An additional water resource present in Toano Draw Subbasin is a large quantity of groundwater now stored in the aquifer. The estimated total volume of unconsolidated sediment present as valley infill along the broad valley of Toano Draw is 44,000,000 ac-ft. The volume of water present within this aquifer is probably on the order of 10,000,000 ac-ft (porosity about 25 percent). It is likely that only water present within 100 feet of the water table surface might be available for power plant uses, and that the aquifer within this zone would yield only 10 percent of its gross volume to wells. Based on those assumptions, it is estimated that at least 500,000 ac-ft of water is potentially available from aquifer storage in Toano Draw Subbasin. Using similar assumptions, it is estimated that about 200,000 ac-ft would be available from aquifer storage beneath the Gamble Ranch area (Water Resources Technical Report).

4.6 ECOLOGICAL RESOURCES

4.6.1 STUDY AREA DEFINITION

The study area for ecological resources is defined as the areas associated with ground-disturbing activities for the proposed action and alternatives (including the exchange lands).

The focus of analysis for ecological resources is on the exchange lands in Toano Draw with potential to be affected by project facilities. The selected lands include mule deer yearlong and winter habitats (4836 acres), antelope winter and summer habitats (13,491 acres), elk summer and winter habitats (1479 acres), and sage grouse brooding, breeding, and wintering habitats (1525 acres). Important wildlife habitats in the offered lands include 11,241 acres of mule deer summer habitat, 13,335 acres of antelope summer habitat, 1365 acres of brooding and wintering sage grouse habitat, and 8.1 miles of creeks (Table 4.6-1). The ecological resources of the offered lands are described from a regional perspective. In addition, an inventory of waters and riparian/aquatic habitats on the offered lands in the Snake Mountains was conducted by BLM biologists to determine the value of these resources (BLM 1986a). This inventory included field work in Loomis Creek, Pole Creek (eastern and western slopes), and Cold Springs watersheds, and is summarized in this report.

In addition to the areas that would be directly disturbed, other areas would be indirectly affected. For purposes of the ecological impact analysis, the area of influence for indirect impacts is assumed to be the area from the Snake Mountains east to the Utah stateline, and from Wells, Nevada north to the Idaho stateline. This area was analyzed because it encompasses the region which is within a reasonable travel distance to recreation for the anticipated workforce and could receive impacts from increased human disturbance. In addition to this area defined for indirect impacts, an even larger area was examined for the potential impacts from acid deposition. Because acid deposition is a long distance transport issue, the area of potential impacts was defined by the air current patterns discussed in Section 4.1.2.4.

4.6.2 VEGETATION RESOURCES

4.6.2.1 Vegetative Communities in Toano Draw Area

Within the plant site area and the selected lands, including Thousand Springs Creek, the following vegetation types were identified: Black Sagebrush, Shadscale, Saltbush, Big Sagebrush, and Riparian. Minor vegetation phases which were identified within the area included Winterfat, Mixed Desert Shrub, and Crested Wheatgrass. Each vegetation type is described in the following sections. Complete species lists, cover data, and shrub densities are included in Appendix A of the Ecological Resources Technical Report.

Black Sagebrush Type. This vegetation type occurs on shallow soils, usually on convex positions of alluvial fans found on the plant site. This is a low-growing vegetation type dominated primarily by black sagebrush, which is generally less than 15 inches high. Associated shrubs include viscid rabbitbrush, shadscale, and budsage.

Big Sagebrush Type. This vegetation type occurs mainly on deep, gravelly loam soils on concave positions between alluvial fans. The dominant shrub

Table 4.6-1. SUMMARY OF TYPES AND APPROXIMATE AMOUNTS OF WILDLIFE HABITAT WITHIN THE EXCHANGE LANDS

Habitat Type		Selected Lands	Offered Lands
Mule Deer Yearlong[a]		4,377	0
Mule Deer Winter[a]		459	0
Mule Deer Summer[a]		0	11,241
	Subtotal	4,836	11,241
Antelope Winter[a]		955	0
Antelope Summer[a]		12,536	13,335
	Subtotal	13,491	13,335
Elk Summer[a]		493	0
Elk Winter[a]		986	0
	Subtotal	1,479	0
Sage Grouse Leks		3	2
Sage Grouse Brooding Ground[a]		462	630
Sage Grouse Winter[a]		1,063	735
	Subtotal	1,525	1,365
Streams with Coldwater Fishery[b]		0	6.9[c]
Streams with no Fishery[b]		0	1.2
	Subtotal	0	8.1

[a] Acres

[b] Miles

[c] Includes 4.6 miles of Loomis Creek and 2.3 miles of Pole Creek.

is big sagebrush, which is often greater than 20 inches in height. Commonly associated shrubs include shadscale and viscid rabbitbrush.

Saltbush Type. This type is dominated by sickle saltbush, which occurs on loamy soils, generally within epthemeral floodplains. The shrub stratum is very low, generally less than 8 inches.

Shadscale Type. This type, which is similar to the Saltbush type, is dominated by shadscale. Additionally, the Shadscale type generally occurs on the floodplains of ephemeral drainages which are located in topographically higher positions. The shrub canopy is usually less than 12 inches in height.

Winterfat Type. This vegetation type, which is dominated by winterfat, occurs as small inclusions within the Big Sagebrush type. Other plant species which are associated with this type include budsage, squirreltail, Indian ricegrass, and tansy mustard.

Rabbitbrush Type. This type is dominated by viscid rabbitbrush and occurs on gravelly soils and substrates. It is largely a transitional vegetation type which occurs on topographic positions between the Big Sagebrush and Black Sagebrush types. Associated species include squirreltail, Indian ricegrass, shadscale, big sagebrush, and black sagebrush.

Crested Wheatgrass Seeding Type. Crested wheatgrass was planted in the northwestern portion of the plant site area. Most of the associated plants appear to be invading from adjacent communities with big sagebrush being the primary invader.

Riparian Type. Estimates of the areas of wetland/riparian habitat and miscellaneous types for each complex are summarized in Table 4.6-2. Wetland/riparian habitats in the Thousand Springs valley bottom were classified according to hydrologic, soil, and vegetative criteria. Each type of habitat was then evaluated to determine if it qualified as a "jurisdictional wetland." Wetland vegetation is considered jurisdictional wetland if it exhibits each of three characteristics; wetland hydrology, hydric soils, and hydrophyllic vegetation, as defined by the Army Corps of Engineers (1987).

Wetland/riparian habitats were inventoried (mapped) at two levels of resolution. Complexes, consisting of two or more wetland/riparian habitats were mapped from 1:24,000 scale orthophotos for the area between Highway 93 and the Utah border. The smallest complexes were about 3 acres in size. Discrete wetland/riparian habitats were mapped from 1:4800 scale aerial photos for representative reaches of the valley bottom. The smallest wetland/riparian habitats identified were about 0.05 acres in size. Inventories of wetland/riparian habitats were used to estimate the composition of complexes.

Table 4.6-2. ESTIMATED AREAS OF VEGETATION TYPES IN THE THOUSAND SPRINGS VALLEY BOTTOM BETWEEN HIGHWAY 93 AND THE UTAH BORDER

Wetland/Riparian Habitat	Area (acres)	Proportion of Valley Bottom (%)
Wetland	515.0	2.2
Drained Wetland	186.4	0.8
Wet Meadow	282.0	1.2
Hay Meadow	3603.1	15.5
Alkali Meadow	2406.2	10.3
Willow	188.8	0.8
Crop	1421.5	6.1
Fallow Crop	995.0	4.3
Water	228.5	1.0
Shoreline	424.4	1.8
Upland Shrub	12967.5	55.6
TOTAL	23313.3	100.0

Source: White Horse Associates 1989 (Appendix B of Ecological Resources Technical Report)

Five major wetland/riparian habitats and six miscellaneous types were identified in the Thousand Springs Creek valley bottom. The wetland/riparian habitats are marsh, wet meadow, hay meadow, alkali meadow, and sandbar willow. Large areas of upland shrub habitat were also identified in the valley bottom. Miscellaneous habitat types identified in the valley bottom are crack willow, crop, fallow crop, road, shoreline, and water. Brief descriptions of major wetland/riparian habitat follow. More detailed descriptions are provided in the Ecological Resources Technical Report.

Marsh Wetland/Riparian Habitat. This habitat was associated with springs, seeps, stock ponds, and beaver ponds in the Thousand Springs valley bottom. Marshes are jurisdictional wetland. Two areas of drained marsh were identified near Winecup Ranch between Twentyone Mile Draw and Twentyone Mile Reservoir. Approximately 515 acres of marsh are found in the Thousand Springs Creek valley bottom.

Wet Meadow Wetland/Riparian Habitat. This habitat occurs in concave positions on floodplains. It is most common in old channels that have been filled with sediment. Wet meadows occur in association with marshes and hay meadows and include 282 acres in the valley bottom. The distribution of wet meadows has been affected by agricultural management, forming behind small earth dams used to distribute and retain spring runoff over haylands. Wet meadows are jurisdictional wetlands.

Hay Meadow Wetland/Riparian Habitat. This habitat occurs on 3603 acres of floodplains in the Thousand Springs valley bottom. It usually is associated with alkali meadows and smaller proportions of wet meadows. Leaching from irrigation has resulted in an increase in the area of hay meadows at the expense of alkali meadows. It is likely that willows were cleared from much of the area that is now hay meadow. Hay meadows are jurisdictional wetlands.

Alkali Meadow Wetland/Riparian Habitat. This habitat was found on the bottom edges of alluvial fans and on convex positions on 2406 acres of floodplains. It occurs on slightly higher positions in association with hay meadows and smaller proportions of wet meadows. Some areas that were once alkali meadow have been leached and converted to hay meadows. Included in this diverse wetland/riparian habitat are small areas dominated by basin wildrye, small areas of upland shrub, and small areas of nonvegetated playas. Alkali meadows are jurisdictional wetlands. Small inclusions of upland habitat are also prevalent within these communities.

Willow Wetland/Riparian Habitat. Willows were found on levees and floodplains and comprises 188 acres of the Thousand Springs valley bottom. Willows were once more extensive, but have been cleared to create hay meadows. Sandbar willow, the dominant shrub, is a species that typically colonizes disturbed sites. This wetland/riparian habitat includes both jurisdictional wetlands and uplands.

Upland Shrub Habitat. Upland shrub habitat is not a jurisdictional wetland and occurs on floodplains of ephemeral tributaries and on floodplains of Thousand Springs Creek where the stream channel incision varies from 4 to over 20 feet. Approximately 12,968 acres of upland shrub habitat occurs in the Thousand Springs Valley bottom.

Miscellaneous Habitat Types. Miscellaneous habitat types comprised a small portion of the valley bottom and are not jurisdictional wetlands.

Complexes. Complexes, consisting of two or more wetland/riparian habitats and/or miscellaneous types are illustrated on Figure 4.6-1. The areas of complexes in the Thousand Springs valley bottom between Highway 93 and the Utah border are listed in Table 4.6-3. The valley bottom includes channels, levees, and floodplains with distinctive morphology reflecting stream deposition, and the toes of some alluvial fans where wetland/riparian habitat is prevelant. Upland habitats (residual, alluvial, and lacustrine) were identified based on geomorphic criteria. Upland complexes comprise the vast majority of the survey area (93 percent). Brief descriptions of the composition of complexes follow.

Marsh Complex. Five polygons of this complex were delineated. They comprise about 4 percent of the Thousand Springs valley bottom. The marshes identified near the Winecup Ranch and near the confluence of Twentyone Mile Draw are drained. The small marsh identified north of Fivemile Ranch is associated with a spring and has recently been fenced to protect it from livestock. Two larger delineations of marsh complex were identified near Dake Reservoir. While the latter delineations contain large proportions of hay meadow (about 25 percent), alkali meadow (about 20 percent), and wet meadow (10 percent), they include some of the finest wetlands in the survey area. These wetlands are associated with seeps leeking from the edge-slopes of lake terraces. Marshes with organic soils over 6 feet deep were identified east of Dake Reservoir.

Hay Meadow Complex. Seven polygons of this complex comprise about 16 percent of the Thousand Springs valley bottom. The named component comprises about 75 percent of this complex. It also includes alkali meadow (15 percent), wet meadow (5 percent), and willow (5 percent) wetland/riparian habitats. Very minor areas (<1 percent) of marsh are also included.

Alkali Meadow Complex. Seventeen small polygons of this complex comprise about 5 percent of the Thousand Springs valley bottom. The named component comprises about 75 percent of this complex. Included are small areas of hay meadow (10 percent) and upland shrub habitat (15 percent).

Cropland Complex. Five polygons of this complex, all located below Twentyone Mile Reservoir, comprise about 12 percent of the Thousand Springs valley bottom. About 50 percent of the complex is irrigated alfalfa and 35 percent is fallow. Upland shrub habitat makes up about 10 percent of the complex. Alkali meadow and miscellaneous types comprise the remaining 5 percent.

Table 4.6-3. ESTIMATED AREAS AND COMPOSITIONS OF COMPLEXES FOR THE THOUSAND SPRINGS VALLEY BOTTOM BETWEEN HIGHWAY 93 AND THE UTAH BORDER

Complex Vegetation Type	Composition (%)	Area (acres)
Marsh Complex		
Marsh	35	326.2
Alkali meadow	20	186.4
Hay Meadow	25	233.0
Drained Marsh	10	93.2
Wet Meadow	10	93.2
TOTAL	100	932.1
Hay Meadow Complex		
Hay Meadow	75	2832.7
Alkali Meadow	15	566.5
Willow	5	188.8
Wet Meadow	5	188.8
TOTAL	100	3777.0
Alkali Meadow Complex		
Alkali Meadow	75	905.5
Hay Meadow	10	120.7
Upland Shrub	15	181.1
TOTAL	100	1207.3
Crop Complex		
Crop	50	1421.5
Fallow Crop	35	995.0
Upland Shrub	10	284.3
Alkali Meadow	5	142.2
TOTAL	100	2843.9
Reservoir Complex		
Water	35	228.5
Shoreline	65	424.4
TOTAL	100	652.9
Upland Shrub Complex		
Upland Shrub	90	12502.1
Alkali Meadow	3	416.7
Hay Meadow	3	416.7
Miscellaneous	4	555.6
TOTAL	100	13891.2

Source: White Horse Associates 1989 (Appendix B of Ecological Resources Technical Report)

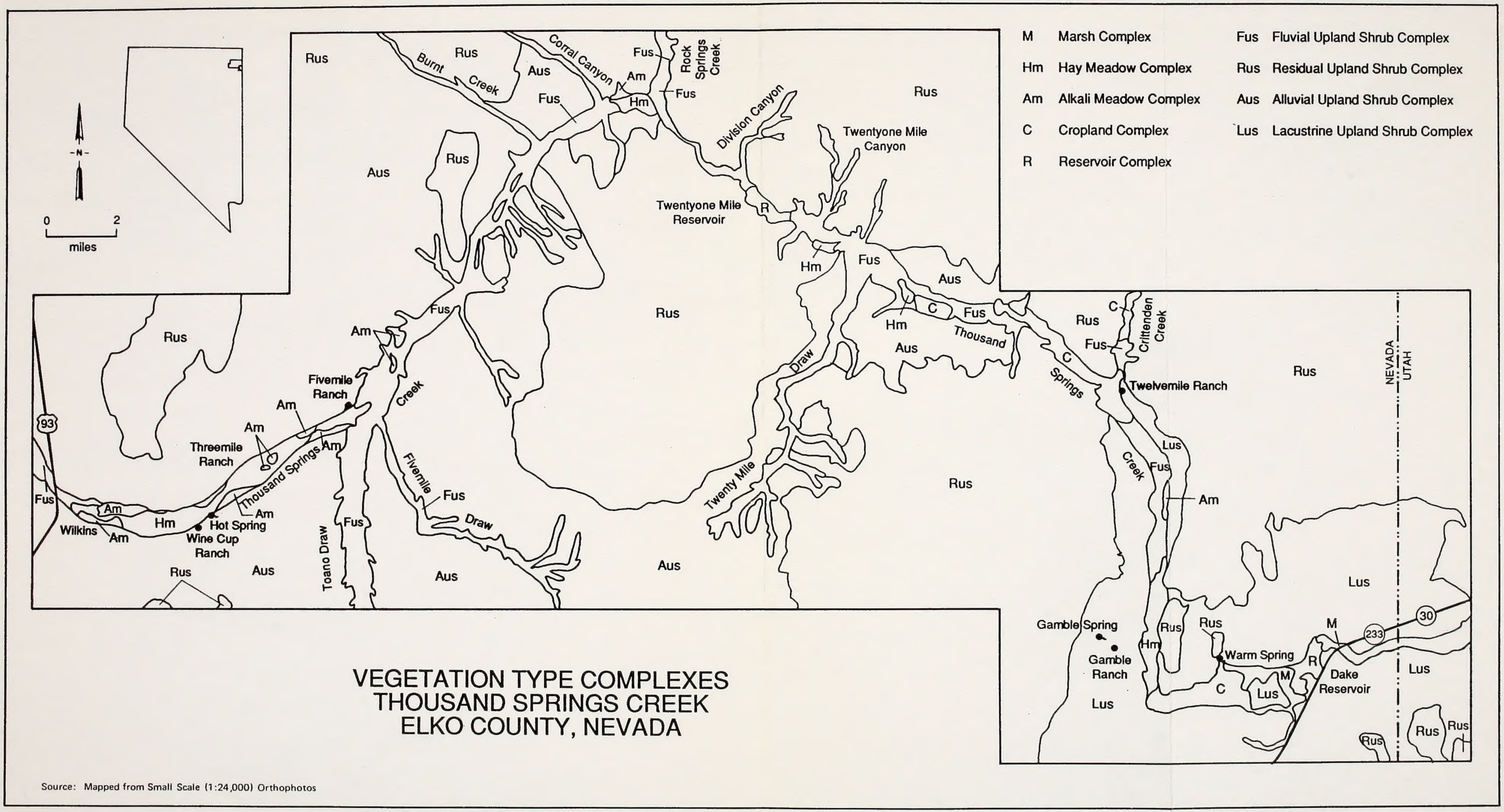


Figure 4.6-1. VEGETATION TYPE COMPLEXES IN THE THOUSAND SPRINGS VALLEY BOTTOM

Reservoir Complex. This complex was identified for Twentyone Mile and Dake Reservoirs and comprises about 3 percent of the Thousand Springs valley bottom. Water comprises about 35 percent of the complex and shoreline comprises the remaining 65 percent.

Fluvial Upland Shrub Complex. Eighteen polygons of this complex comprise about 60 percent of the valley bottom of Thousand Springs Creek and its major tributaries. The named component makes up about 90 percent of delineations. Hay meadow and alkali meadow each comprise about 3 percent of this complex. Miscellaneous types make up the balance.

Residual Upland Shrub Complex. This complex was identified on residual soils associated with mountains and hills in the survey area. Significant areas of alluvial and fluvial upland shrub are included. Very small areas of marsh, hay meadow, and alkali meadow are associated with springs and seeps and comprise a total of less than 1 percent of delineations.

Alluvial Upland Shrub Complex. This complex was identified on alluvial surfaces flanking the valley bottom throughout much of the upper portions of the study area. Significant areas of residual and fluvial upland shrub are included. Very small areas of marsh, hay meadow and alkali meadow wetland/riparian habitats are associated with springs and seeps in this complex and comprise a total of less than 1 percent of delineations.

Lacustrine Upland Shrub Complex. This complex was identified on lake terraces of Pleistocene Lake Bonneville in the lower portion of the survey area at elevations below 5200 feet. Significant areas of alluvial and fluvial upland shrub are included. Very small areas of marsh, hay meadow and alkali meadow wetland/riparian habitats are associated with springs and seeps in this complex and comprise a total of less than 1 percent of delineations.

4.6.2.2 Vegetative Communities in Snake Mountains

Four major vegetation types were identified on the offered lands. These types include Mountain Brush, Low Sagebrush, Big Sagebrush/Bluebunch Wheatgrass, and Riparian types. Descriptions of each type are included in the Ecological Resources Technical Report.

4.6.2.3 Threatened, Endangered, and Candidate Plant Species

Currently, no plant species within the Elko District are Federally listed as "Threatened or "Endangered." Several species are Candidate Category 2 species for which the U.S. Fish and Wildlife Service requires additional information to determine whether listing is appropriate. Others are proposed Candidate Category 2.

Arabis falcifructa - Proposed C2
Astragulus anserinus - C2
Collomia renacta - Proposed C2
Erigeron latus - C2
Eriogonum argophyllum - C2

Ivesia rhypara - C2
Leptodactylon glabrum - Proposed C2
Mentzelia packaridae - C2
Potentilla cottami - Proposed C2
Silene nachlingerae - Proposed C2

Eriogonum argophyllum is listed as the only State of Nevada, Elko District "Critically Endangered" species. It is also presently a Federal Candidate Category 2 species but is recommended to be moved up to Candidate Category 1 status because enough information exists to propose the species for listing as Federal Threatened/Endangered species.

4.6.3 WILDLIFE AND AQUATIC RESOURCES

A detailed discussion of wildlife and aquatic resources, including use areas and migration corridors, is presented in the Ecological Resources Technical Report. The description of wildlife and aquatic resources focuses on several important categories of wildlife and associated crucial habitat: recreationally or commercially important species (generally game species); species characterized by uncertain or declining population status; threatened or endangered species; and species expected to be sensitive to project activities and which, as a result, may not be capable of sustaining current populations. Crucial habitat is defined as an area that is important for the maintenance and perpetuation of wildlife populations. Generally, these areas are characterized by population concentrations during crucial periods (e.g., winter range, breeding or brooding grounds). Within these areas, populations are very susceptible to human disturbance and effects on individuals which may result in the loss of several generations. Species not included in categories designated as "important" include songbirds, small mammals, reptiles and amphibians, and insects. These species are not generally considered recreationally or commercially important, since they are usually capable of rapid recovery and repopulation of disturbed areas due to their large populations, rapid turnover rates, and mobility.

Wild horses are not addressed in the following discussion, because the nearest herd is located in the Pilot Range, approximately 30 miles from the site, and, therefore, would not be affected by the proposed action or alternatives (Portwood 1989).

4.6.3.1 Unique and/or Highly Valued Wildlife Species

Pronghorn Antelope. Antelope occupy the arid grass areas within the study area including the plant site, facility access, exchange lands, and adjacent areas potentially affected by indirect impacts. The estimated population in the study area including the Red Point, Oasis, Toano Draw, Pilot Valley, and Pequop areas, is approximately 510 animals (J. Williams 1989). In addition, new reestablishment efforts in the North Pequop Mountain Range (Williams 1985) and a proposed reestablishment for the Eccles Ranch area are underway to increase the population numbers (BLM 1988b). Currently, Toano Draw is a fawning area for a limited number of

does. Solitary bucks have been observed throughout Toano Draw (Nevada Department of Wildlife [NDOW] 1989; WCC 1981 through 1989). The Toano Draw area is limited for antelope production by the small amount of water available. Yearlong, winter and summer habitat and key areas are shown on Figure 4.6-2. In general, key areas are defined as areas that are extremely important for the maintenance and perpetuation of wildlife populations. These areas are characterized by occurrences of population concentrations during critical periods, e.g., winter range, breeding or brooding grounds. The selected lands include 13,491 acres of winter and summer habitat; the offered lands include 13,335 acres.

Elk. Elk concentration areas are primarily within the Pilot Peak and Crittenden/Twelve Mile Ranch areas (Figure 4.6-3). Elk summer and winter habitats on the selected lands include 1479 acres; no habitat exists on the offered lands. Herd production of these two areas has been very successful. Elk are presently seen in the Gamble Ranch alfalfa fields during the early part of the breeding season.

Mule Deer. Mule deer are the most abundant big game species in the study area and occupy a great variety of habitat types. The selected lands include 4836 acres of yearlong and winter habitat; the offered lands include 11,241 acres of summer habitat. Field observations during winter and spring wildlife surveys were made on several occasions in the vicinity of Twelve Mile Ranch. Total herd numbers in the impact area that may be directly or indirectly affected are estimated to be approximately 23,000 deer (Williams 1989). Migration corridors and use areas are shown on Figure 4.6-4. The major migration route in the study area occurs in the Snake Mountains, Independence Valley, Windermere Hills, and Pequop Mountains. Approximately 5000 to 6000 mule deer migrate through this area as they travel to and from their summer and winter ranges.

Bighorn Sheep. Bighorn sheep have recently been reestablished within the study area. In 1987, approximately 20 animals were released in the Pilot Mountain area. During the winter of 1989, 25 sheep were released in the Contact area.

4.6.3.2 Small- and Medium-Sized Mammals

River otters were observed in July 1988 in Twentyone Mile Reservoir. Other furbearers which may occur within the study area include beaver, muskrat, mink, skunk, and badger. Muskrats were observed on a number of occasions along Thousand Springs Creek. Coyotes are found throughout all habitats in Nevada, although they are most common in the grasslands (Findley et al. 1975).

4.6.3.3 Raptors

Thirteen raptorial species were observed within the study area. Some species are considered permanent while others either only breed or winter in the region. Species observed nesting within the study area include the golden eagle, marsh hawk, and long-eared owl. A golden eagle nest was located south of Schoolhouse Canyon during the ground survey of May 13,

1982. Also, there is a potential bald eagle nest site at Salmon Falls Creek (Lister 1989). In addition, two marsh hawk nests were observed in the Winecup Ranch area. Raptor surveys conducted in 1988 revealed several empty nests in cliff areas throughout areas adjacent to Winecup Ranch; however, no active nests were sighted. A long-eared owl nest was found in the willow riparian area west of the Winecup Ranch. A sharp-shinned hawk was also seen in the area but no nest could be found. An osprey was observed three times during the study period in the Twentyone Mile Reservoir area. In addition, osprey have been observed at Crittenden Reservoir, Boies (also known as Jakes Creek) Reservoir, and along U.S. Highway 93 near Winecup Ranch (Lister 1989). No osprey nesting sites were located. In addition, other species, including red-tailed hawk, prairie falcon, and kestrel, are expected to nest within the study area; however, none were observed nesting.

4.6.3.4 Upland Game

The sage grouse is an important upland species in the study area and generally occurs in low sagebrush-dominated habitat. The selected lands include 1525 acres of brooding, breeding, and wintering habitats. The offered lands include 630 acres of brooding habitat and 735 acres of wintering habitat. Riparian areas provide brooding habitat in late spring and early summer. Three strutting grounds (leks) were reported within a 5-mile radius of the plant site (Figure 4.6-5). Although no nesting or brooding habitats were identified within a 2-mile radius of the proposed plant site, there may be some brooding activity in this area, because up to 80 percent of nesting/brooding areas occur within a 2- to 3-mile radius of leks (Western States Sage Grouse Committee 1974). Other areas where small concentrations of strutting birds were observed include a burned area to the northwest of the Winecup Ranch and some south-facing hill areas in the southeast of the Winecup Ranch. Winter habitat is located within the southern portion of Toano Draw.

Chukar, a form of patridge, are present in the study area. However, in the areas that would be occupied by project components, chukar densities are low to nonexistent. Other upland game species potentially occurring in the study area include the California quail and mourning dove.

4.6.3.5 Waterfowl/Shorebirds and Other Water Birds

Several species of waterfowl and other waterbirds were identified in marsh lands and riparian areas primarily bounding the Thousand Springs drainage between Winecup Ranch and Dake Reservoir. Documented species include mallard, blue and green winged teal, shoveler, canvasback, coot, ruddy duck, gadwall, pintail, redhead, and merganser (Table 4-2, Ecological Resources Technical Report). Other water-type birds observed within the study area include greater sandhill crane, great blue heron, white-faced ibis (federally sensitive species, Table 4.6-4), rails, and phalaropes.

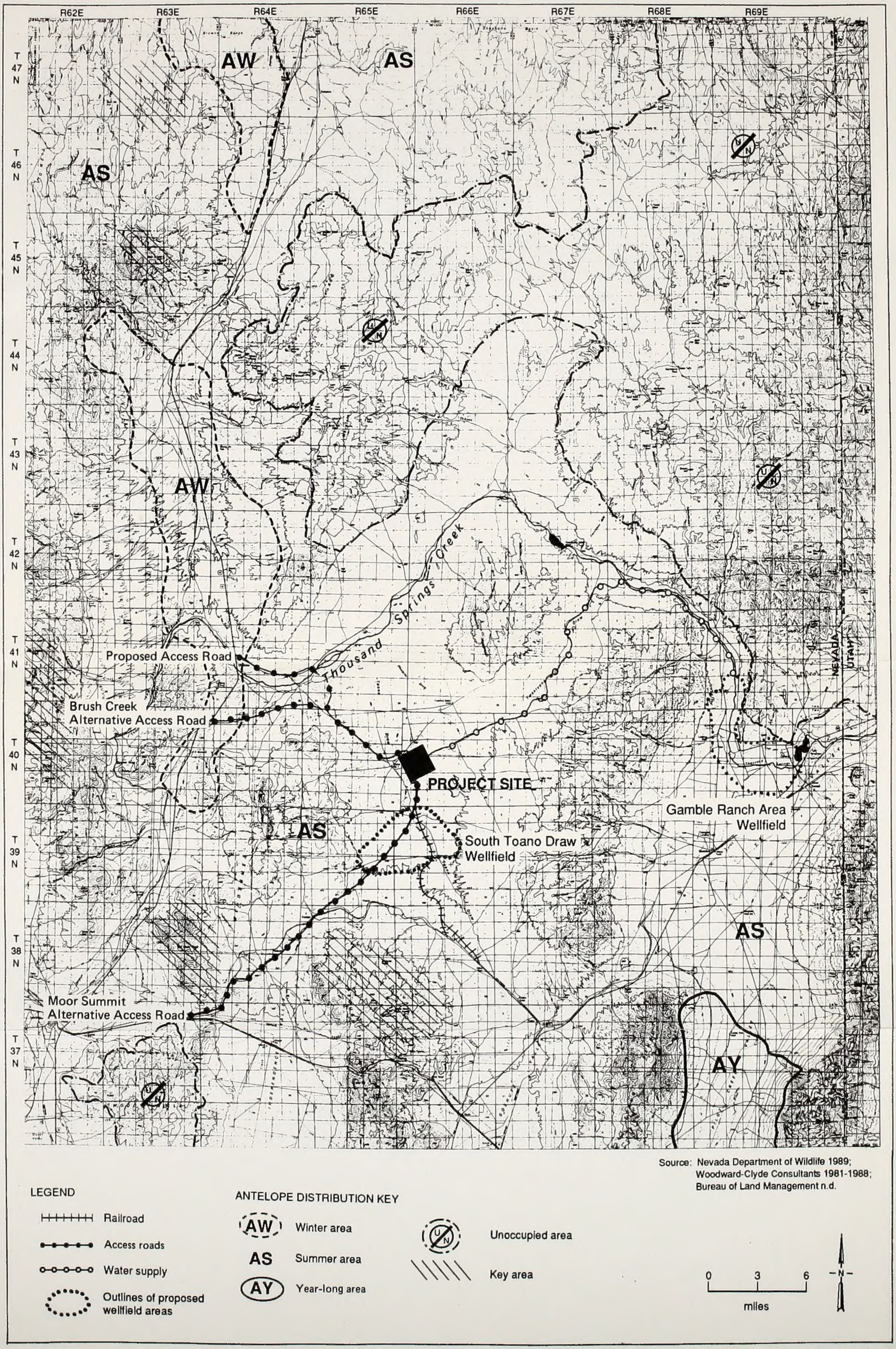


Figure 4.6-2. ANTELOPE HABITAT AREAS

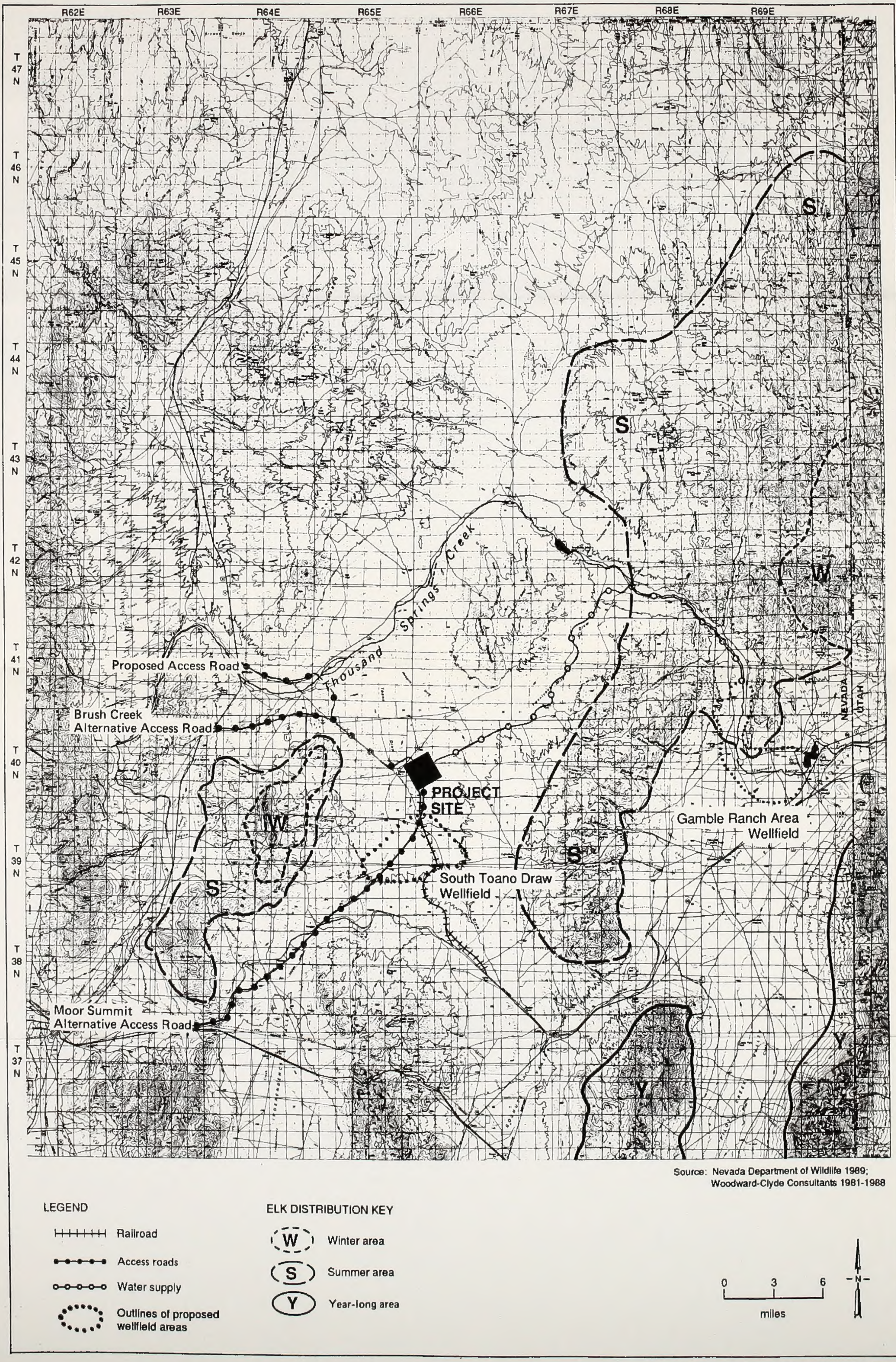


Figure 4.6-3. ELK HABITAT AREAS

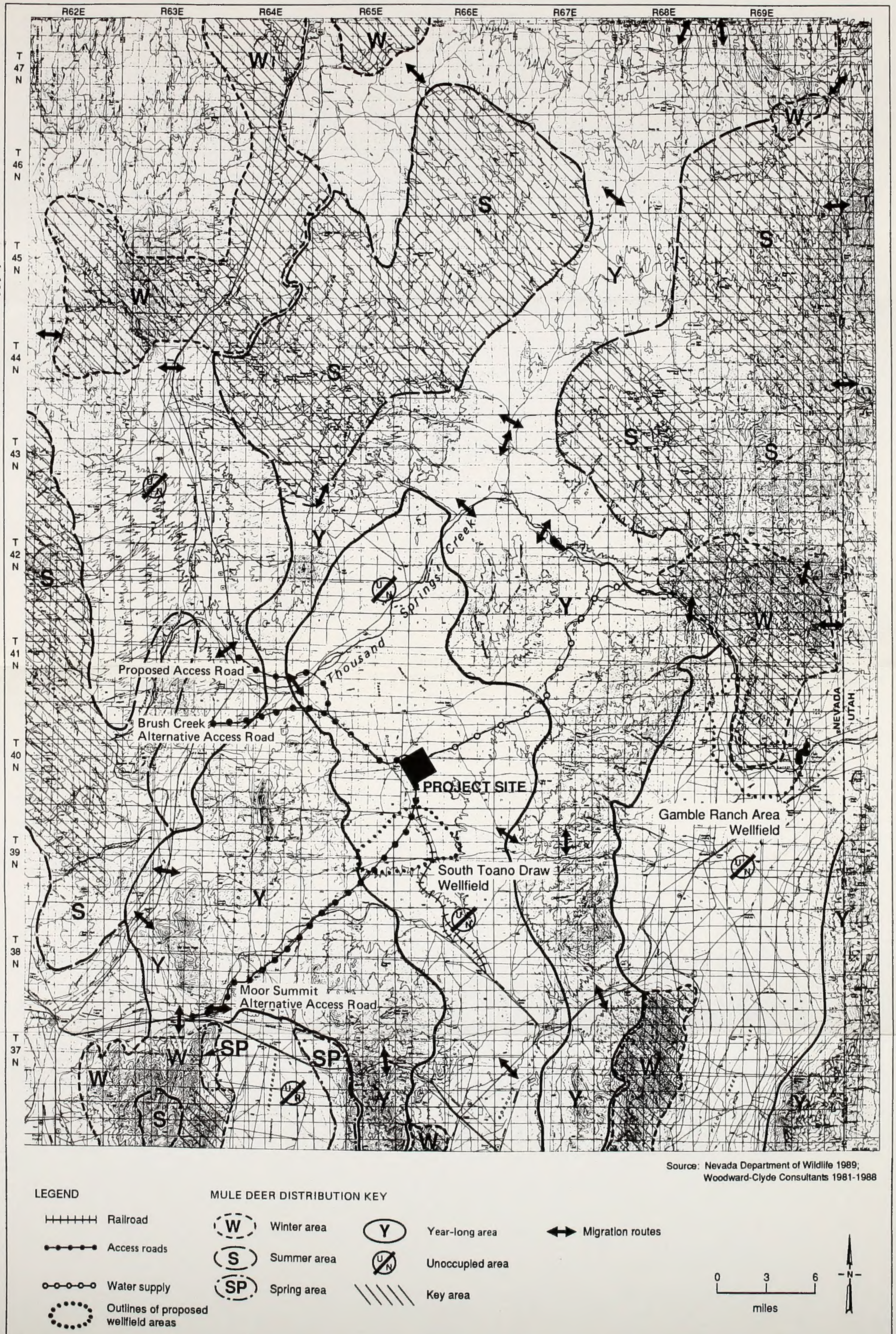


Figure 4.6-4. MULE DEER HABITAT AREAS

Figure 4.6-5. SAGE GROUSE USE AREAS AND STRUTTING GROUNDS

Table 4.6-4. THREATENED, ENDANGERED, AND SENSITIVE ANIMALS POTENTIALLY OCCURRING IN ELKO COUNTY, NEVADA

Species	Status[a]
BIRDS	
Bald eagle (Haliaeetus leucocephalus)	FE, SSS
American peregrine falcon (Falco peregrinus)	FE, SSS
Ferruginous hawk (Buteo regalis)	FSS2
Swainson's hawk (Buteo swainsoni)	FSS2
Long-billed curlew (Numenius americanus)	FSS2
Snowy plover (Charadrius alexandrinus nivosus)	FSS2
White-faced ibis (Plegadis chichi)	FSS2
MAMMALS	
Richard's ground squirrel (Spermophilus richardsonii nevadensis)	FSS2
North American lynx (Felis lynx canadensis)	FSS2
California bighorn sheep (Ovis canadensis californiana)	SSS
Rocky Mountain bighorn sheep Ovis canadensis)	SSS
Spotted bat (Euderma maculatum)	FSS2, SSS

Table 4.6-4. THREATENED, ENDANGERED, AND SENSITIVE ANIMALS POTENTIALLY OCCURRING IN ELKO COUNTY, NEVADA (concluded)

Species	Status[a]
FISH	
Redband trout (*Oncorhynchus* sp.)	FSS2
Relict dace (*Relictus solitarius*)	FSS2, SSS
Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*)	FT
Independence Valley speckled dace (*Rhinichthys osculus lethoporus*)	FSS1
Clover Valley speckled dace (*Rhinichthys osculus oligoporus*)	FSS1
INSECTS	
Mattoni's blue butterfly (*Euphilotes rita mattonii*)	FSS2

FE = Federally listed endangered species.
FT = Federally listed threatened species.
SSS = Nevada State sensitive species.
FSS1 = Federal sensitive species, Category 1.
FSS2 = Federal sensitive species, Category 2.

4.6.3.6 Other Wildlife Species
Nongame birds, and amphibians and reptiles potentially occurring within general habitat associations/communities in the project area include larks, wrens, warblers, and sparrows, and lizards and snakes, respectively.

4.6.3.7 Aquatic Resources
The study area includes a variety of waterbodies which are part of the Humboldt River drainage originating in the Snake Mountains. The majority of these waterbodies are tributaries to or reservoirs on Thousand Springs Creek (Figure 12.0-1). The tributaries, including Loomis and Cold Springs Creeks, are discussed in the Ecological Resources Technical Report. These waterbodies contain a variety of habitat which varies with their location and elevation. Fish populations include self-sustaining populations in the creeks and reservoirs and other populations maintained by stocking. The offered lands contain 8.1 miles of stream habitat which includes 6.9 miles of cold water fishery. The selected lands contain no stream habitat.

Loomis Creek. Loomis Creek is a small, spring-fed creek originating in the Snake Mountains west of Wilkins, Nevada and ending with its confluence with Thousand Springs Creek. The upstream area is characterized by high gradient riffles and small pools. Bank trampling and fines characterized much of this reach, and cattle grazing appears to be responsible for these conditions. Beaver ponds are present downstream. Downstream glide and pool habitats are dominant. Substrates are comprised largely of gravels with small amounts of fines.

Bonneville redside shiners, brook trout, speckled dace, and Paiute chub are found in Loomis Creek. Bonneville redside shiner and brook trout are found at all locations. However, speckled dace are the most abundant.

Loomis Creek is the largest stream on the offered lands (BLM 1986a). The offered lands include 4.6 miles of cold water fishery along Loomis Creek. Based on field surveys conducted by the BLM, this stream has the highest estimated water quantity (e.g., 2.9 cfs approximately 0.4 mile downstream from offered lands) in the offered lands. The overall condition of the riparian/aquatic habitat is rated fair, primarily due to the livestock use of the area. Although the riparian areas could be improved, the fish and wildlife values were considered to be high. Streamside meadows in some areas have been created by beaver dams. Trout may occur throughout Loomis Creek.

Thousand Springs Creek. Five species of fish were found in Thousand Springs Creek. Bonneville redside shiner and speckled dace are the two most common and widely distributed of the species found. Brook trout are primarily found near the confluence of Loomis Creek. During field investigation, one brook trout was observed several miles downstream. Lahontan redside shiners were found between Red Point and Wilkins, Nevada. Utah chub are found between Twentyone Mile Reservoir and Dake Reservoir.

Twentyone Mile Reservoir. The Twentyone Mile Reservoir has a maximum surface area of approximately 250 acres and a maximum depth of 25 feet. It is located along Thousand Springs Creek upstream of Crittenden Creek and Dake Reservoir. It is a small reservoir used to provide temporary storage for irrigation and other agricultural uses for the Gamble Ranch. This reservoir is regularly drawn down completely. Therefore, it provides only temporary fish habitat and cannot support permanent fish populations. It is likely that redside shiners and dace are present at certain times of the year due to washout from upstream habitats.

Dake Reservoir. Dake Reservoir has a maximum surface area of 490 acres and a maximum depth of approximately 20 feet. Although Dake Reservoir receives surface water from Thousand Springs Creek and releases from Twentyone Mile, and Crittenden Reservoirs, this reservoir probably is primarily supplied by groundwater discharges directly into the reservoir. The reservoir is surrounded by alkaine remnant meadow with saltgrasses. This reservoir has been stocked with northern pike and largemouth bass. These populations are now self-sustaining, as is a population of Utah chub.

Crittenden Reservoir. Crittenden Reservoir is a 4300-ac-ft irrigation reservoir and also supports some recreational use. Total surface area is 360 acres and maximum depth is about 33 feet. The reservoir is partially filled each year and then drawn down to supply irrigation water. A series of springs provide water to the reservoir throughout the year, allowing some limited recreational use. Bottom sediments consist primarily of fines.

This reservoir is annually stocked with rainbow trout. Largemouth bass were introduced between 1965 and 1974 and are self-sustaining. Cutthroat trout are found but appear to be relatively rare. Utah chub were historically found in this reservoir but were removed by NDOW using chemical treatment methods in 1961.

Cold Springs Creek. Cold Springs Creek is a small tributary of Loomis Creek originating in the Snake Mountains. Near the headwaters, riffle-pool-cascade habitats are present. Pools comprise over 55 percent of the stream habitat. Cobble and gravel substrates dominate. Riparian vegetation provided overhead cover. Downstream habitats are characterized by beaver ponds and low gradient riffles. Fines are the dominant substrates and little overhead cover is present in the area of the ponds. Further downstream, overhead cover is more abundant and riffles and small pools are the dominant habitats. Cold Springs Creek within the offered lands crosses 1.2 miles but contains no fishery.

The BLM also inventoried the Cold Springs watershed and rated the overall riparian and aquatic condition as good (BLM 1986a). The fisheries values were rated low, primarily because of the small size. Abundant stands of aspen and mountain brush contribute to a high wildlife value.

Pole Creek Watershed (Eastern Slope). This is the second largest creek in the offered lands (BLM 1986a). Approximately 2.3 miles of cold water fishery along Pole Creek are included on the offered lands. Livestock use, erosion, decreased water table, and reduced riparian vegetation have contributed to low fish and wildlife values. The degradation of riparian vegetation, primarily aspens, has been exacerbated by beavers. During the 1986 BLM field assessment, no adult trout were observed in the creek, only young trout. Emigrations or low adult populations may account for the lack of adults.

Pole Creek Watershed (Western Slope). In areas where livestock graze, the habitat value was rated poor to fair by the BLM (1986a); however, the riparian and aquatic condition is excellent in areas where there is no livestock. The waterflow is low in some areas; therefore, the fisheries and wildlife values in these locations range fron low to moderate. In contrast, areas with suitable streamflow and ponds have excellent wildlife because of abundant water and associated stands of willows and aspens. It should be noted that this portion of the Pole Creek watershed is outside the boundaries considered in the study area for analysis.

4.6.3.8 Threatened, Endangered, and Sensitive Species

"It is the Bureau policy to protect, conserve, and manage Federal- and state-listed or candidate listings of sensitive, threatened, or endangered animals and to use its authorities in furtherance of the purpose of the Endangered Species Act (ESA) and similar state laws. All candidate species for Federal threatened, endangered status and all state-listed threatened, endangered, and sensitive species must be accorded the full protection of the ESA. It is also policy to ensure that the habitats of all sensitive animals are managed and/or conserved to minimize or eliminate the need for Federal or state listing in the future" (BLM 1986b). In compliance with this policy, species observed and/or potentially occurring in the study area are considered in this EIS.

Federal-listed threatened, endangered, and sensitive species potentially occurring in Elko County are listed in Table 4.6-4 (BLM 1986b). Of those species, the long-billed curlew, white-faced ibis, and peregrine falcon were observed in the study area. The long-billed curlew and white-faced ibis are both Federal-listed sensitive species, Category 2. During three surveys conducted at Dake Reservoir in July 1988 a total of 10 long-billed curlews and 20 white-faced ibis were recorded. Based on habitat type within the study area, other species such as the ferruginous hawk and Swainson's hawk are expected to occur in the project area (BLM 1986b).

A peregrine falcon was observed on May 11, 1982 in a pasture just west of Winecup Ranch. This species is classified as a Federally endangered species throughout its entire range as published in the Federal Register (35FR 16047, October 13, 1970; 35FR 8495, June 2, 1970; and 35FR 18320, December 3, 1970). This species is probably a migrant in the study area and is not nesting or a resident.

The range of Lahontan cutthroat trout, a Federally threatened species, occurs on the east slope of the Pilot Mountains (Lister 1989). However, field investigations conducted during July 1986 in Loomis, Cold Springs, and Thousand Springs Creek did not reveal the presence of this species. It is more commonly found in the Lahontan drainage, west of the Snake Mountains. Also, the Lahontan cutthroat trout is known to occur in 41 streams and potentially occurs in at least 20 streams in the Humboldt National Forest (USDA 1985). The known populations have been identified in the roadless areas of the East Humboldt, Santa Rosa, Ruby Mountain, and Independence Mountain regions of the Humboldt National Forest.

4.7 CULTURAL RESOURCES

Cultural resources include prehistoric and historic archaeological sites, historic architectural and engineering remains, and sites of traditional value or religious importance to Native Americans or other ethnic groups.

4.7.1 STUDY AREA DEFINITION

The study area for the cultural resources analysis is defined as an area large enough to include all presently known project activity areas, as well as areas where impacts could occur as a result of increased population or infrastructural changes in land use. The study area, covering 661 square miles, is defined as the maximum viewshed, i.e., those areas visible from project elements (Cultural Resources Technical Report, Figure 2). A complete description of the study area and the cultural resources analysis is provided in the Cultural Resources Technical Report. A summary discussion of prehistory, ethnography, and history for the study area derived from that study is provided below.

4.7.2 PREHISTORY

The prehistory of the eastern Great Basin has been summarized by Jennings (1978), James (1981), Madsen (1982a), and Aikens and Madsen (1986). Central and western Great Basin prehistory has been reviewed by Elston (1982, 1986) and Elston and Budy (1989).

Four major periods are recognized in northeast Great Basin prehistory, including the Paleo-Indian, Archaic, Formative, and Post-Formative periods. The model applied typically to the Paleo-Indian Period, 12,000 to 9500 years ago, postulates a climate cooler and wetter than at present, and subsistence and settlement activities that focused on large lakes and marshes (Currey and James 1982; Davis 1982; Madsen 1982a). While the use of upland resources did occur in the period, that use seems to have been restricted (Madsen and Berry 1975; Madsen 1982a). The Paleo-Indian artifact assemblage is distinctive, reflecting an adaptation focused on big-game hunting by small, highly mobile groups. (Elston 1982, 1986; Kelly and Todd 1988; Madsen et al. 1976; Miller and Dort 1978). Although their importance in the diet is uncertain, small game and plant foods probably were also used (Elston 1982; Madsen 1982a; Simms 1987).

Patterns apparent over the Archaic Period, 9500 to 1500 years ago, include a steady increase in the use of uplands (Lindsay and Sargent 1979; Janetski 1985; Zeier and Zeanah 1987), a fluctuating use of lacustrine resources, and an increase in the number of occupied sites through the Middle Archaic, 6000 to 3500 years ago, followed by an apparent decline in the Late Archaic (Madsen 1982a, 1982b), 3500 to 1500 years ago. Various hypotheses have been advanced to explain these patterns: population growth led to expansion into the uplands (Simms 1977; Madsen 1982a; Madsen and Jones n.d.); deterioration of lakeside environments due to fluctuating climatic conditions (Madsen 1982b; Madsen and Berry 1975); and establishment of upland pinyon communities (Thompson and Hattori 1983) prompting greater use of upland areas (Simms 1985).

The Formative Period, 1600 to 650 years ago, saw the entrance into the eastern Great Basin of maize horticulturalists. The origin and fate of this group, referred to as the Fremont, remains unresolved (Marwitt 1986; Anderson 1982). It is of particular interest that many regional sites exhibit a hiatus between Late Archaic and Fremont components, suggesting a general population decline between 2500 and 1500 years ago (Madsen 1982a; Aikens and Madsen 1986). Elements of preceding Late Archaic artifact assemblages continue in Fremont contexts, while pottery and clay figurines and new forms of basketry appear (Jennings 1978; Adovasio 1986). Most large Fremont sites are located on alluvial fans adjacent to marsh or riverine water sources (Berry 1972; Lindsay 1976), ideal settings for horticulture. In eastern Nevada, Fremont components often are located in open sites or caves occupied for brief periods in areas which exhibited limited horticultural potential. The role of such sites in Fremont subsistence has long been a matter of discussion (Fowler et al. 1973; Dalley 1976; Berry 1972; Madsen 1982b).

The Post-Formative Period, 650 to 100 years ago, is assumed to correlate with the expansion of Shoshone and Paiute groups, speakers of Numic languages, into the eastern Great Basin (Lamb 1958; Madsen 1975). Artifact assemblages differ from the preceding Formative Period, mostly with regard to the types of pottery and basketry found (Madsen 1986b; Adovasio 1986).

4.7.3 ETHNOGRAPHY

The study area lies within the territory of the Western Shoshone. The Western Shoshone language is classified as a variant of central Numic languages. The Northern Shoshone may have made forays into the area from southern Idaho. The Western Shoshone inhabited the area ranging from southeast California, through central Nevada, and into northwest Utah. Ethnographic data for the Shoshone have been summarized by Janetski (1981), Murphy and Murphy (1986), and Thomas et al. (1986).

The Shoshone employed a flexible subsistence and settlement system based on the scheduling of activities according to the seasonal availability of foods, and they relied heavily on pinyon, bighorn sheep,

and antelope. The nuclear family, the basic social and economic unit, was largely self-sufficient. Three to ten such families formed a band that occupied semi-permanent winter camps and, at times, foraged together for parts of the year. Group membership was quite fluid. Larger groups formed to take advantage of seasonal resource concentrations (Steward 1938). Thousand Springs Creek Valley provided permanent water and could have supported a stable Shoshone population. Ethnographic data specific to the area are few and the extent to which the Shoshone exploited the study area is unclear. In the 1850s U.S. Indian Agents reported the presence of 600 to 1000 Indians in the Thousand Springs Valley (ARCIA 1853, 1856) who may have wintered in Fort Hall (Steward 1938). There are a number of Post-Formative sites recorded to date in the area.

4.7.4 NATIVE AMERICAN CONCERNS

Federal regulations for the protection of historic properties (36 CFR 800) provide for the involvement of tribal governments when a project may affect Indian lands, and for the involvement of traditional cultural leaders and other Native Americans when a project on non-Indian lands may affect properties of historic value to an Indian tribe.

Descendants of Western Shoshone, Gosiute, and Bannock Indians who lived on or used the study area still reside in Nevada, Utah, and Idaho. Because of these traditional ties, they may have concerns about archaeological sites and other places within the study area that may be affected by the project. To contact potentially concerned Native Americans, letters were sent to Western Shoshone, Gosiute, and Bannock tribal groups, political organizations, and recognized elders (see Section 6.0 for a list of those contacted).

The project area lies within the boundaries of Western Shoshone territory, as established in the 1863 Treaty of Ruby Valley (18 Stat. 689). The project area falls within those treaty boundaries. The Western Shoshone filed a case with the U.S. Indian Claims Commission that was decided in 1977 and affirmed in 1979. Monetary compensation was awarded to the Western Shoshone for lands that the Commission determined they had held and used exclusive of other tribes. This "exclusive-use" territory is smaller than that covered by the Treaty of Ruby Valley. The study area falls outside the Western Shoshone territory recognized by the Indian Claims Commission.

The monetary award has not been distributed to the Western Shoshone because they have refused to cooperate with the Secretary of the Interior to devise a plan for distribution of the funds. A longstanding dispute between the tribe and the U.S. continues, with the tribe contending that they never ceded lands and have refused compensation awarded by the U.S. Government for the contested lands, while the U.S. contends that aboriginal title was extinguished when the monetary award was certified for payment in 1979. The case was argued by members of the Western Shoshone Tribe in the United States Supreme Court in 1984, and in 1985 the Court decided that the

appropriation and deposit of funds into a trust account in the United States Treasury constituted payment and upheld that the aboriginal title was extinguished. In 1986 land title rights with respect to grazing were again contested by two members of the Western Shoshone Tribe. It was concluded that grazing would be permitted in public domain in light of the defendants' continuous, ancestral use of the lands. However, the defendants were precluded from asserting the aboriginal title regarding the judgment of 1979 (U.S. District Court 1986).

As a result of the Native American consultation effort, some people were identified who still have memories of traditional activities in the project area. Some tribal councils and individuals expressed general concerns about protection of graves and sacred places, and about the need to protect traditionally hunted animals and traditionally gathered plants and to provide continued access to hunting and gathering areas. The Western Shoshone Elders Council called a meeting to explain their concerns, and were joined by representatives of most of the Shoshone tribal groups and political organizations. Their primary concern was the issue of title to traditional Western Shoshone territory. They contend that BLM-administered lands in the project area are Western Shoshone lands and that, therefore, the BLM has no authority over those lands. They declined to discuss specific concerns about graves, sacred places, hunting and gathering areas, or other issues that might be affected by the project. The case was re-opened, and the decision of 1986 was upheld by the U.S. Circuit Court of Appeals (Reno Gazette Journal, October 11, 1989).

4.7.5 HISTORY

Five major themes are identified that structured historic period events in northeast Nevada (Judd 1985). Of these, exploration (fur trapping), mining, and major settlements occurred in the region, but had limited impact on the immediate study area. The remaining themes are transportation and ranching.

The California Emigrant Trail crosses the north portion of the study area, following Thousand Springs Creek (Helfrich et al. 1984). First pioneered by Joseph Walker in 1843, use of the trail by emigrants continued, at varying levels of intensity (reaching a peak of up to 50,000 people per year), until 1869 when the railroad took its place as a means of transcontinental travel and shipping. The hot springs situated northeast of the present Winecup Ranch were a popular campsite where some emigrant parties stayed to recuperate before moving on to the Humboldt River (Helfrich et al. 1984). The earliest non-Indian settlement in the study area occurred when small ranches and trading posts were established to provide produce, fresh dray animals, and services (Zeanah and Zeier 1989).

The search for a transcontinental railroad route began in 1853. An exploration party led by Lieutenant E.G. Beckwith was charged with exploring the portion of the central route that passed through northeast Nevada. A map prepared by Beckwith contains the earliest use of the name

Thousand Springs Valley (Carlson 1974). Construction of the transcontinental line by the Union Pacific and Central Pacific began in 1863, but construction in the study area did not occur until 1868 and 1869. The construction force was composed of Euro-Americans and Chinese, between whom there was a strict division of labor and social segregation. Once the line was completed, Chinese work gangs roamed its length, improving structures and replacing rail. Construction and operation of the railroad supported the first large-scale communities in northeast Nevada, including Tecoma, Toano, and Wells. The line was taken over by the Southern Pacific Railroad in 1899 and upgraded between 1901 and 1903. A major section of line between Moor Summit and Toano was replaced. Reorganization of the stations along the line led to the abandonment of Tecoma and Toano, and the establishment of Montello (Patterson et al. 1969; Myrick 1962).

Two other railroads were constructed along the periphery of the study area during the 20th century (Myrick 1962; Patterson et al. 1969). Western Pacific, which passes just south of the area, was constructed between 1907 and 1909. The second line is the Union Pacific, sometimes referred to as the Oregon Shortline rail link between Wells and Twin Falls, Idaho, constructed in 1923. The line discontinued service in the early 1970s.

Freighting and staging were vital elements of 19th century transportation, facilitating the movement of people and goods (Mills 1956). The earliest stage and freight lines to cross the study area made use of the Emigrant Trail until 1858, when most traffic shifted to the shorter route through central Nevada. During this early period, Nevada represented a place to travel across and seldom a destination. This changed with the establishment of numerous remote mining communities, many of which were linked to outside markets only by freight and stage lines. Numerous lines were established in northeast Nevada, connecting these towns to the transcontinental railroad. One such operation was the Idaho Fast Freight Line which ran between Toano and Twin Falls, Idaho, from 1874 until 1884. This line made use of a wagon road that ran the length of Toano Draw, passing through the heart of the study area (Mills 1956).

Without question, ranching has played the greatest and most consistent role in the history of the study area. Ranching began as a support industry, providing fresh foods and stock to travelers along the Emigrant Trail. As mining became established, larger local markets opened up and small, relatively isolated family operations increased in number. With completion of the transcontinental railroad in 1869, regional and national markets were opened to ranchers along the way, and gradually the size of local operations began to increase. This pattern was intensified by the very harsh winter of 1879; many operators were forced out of business, and those ranchers who survived the winter expanded their operations into the vacated areas (Hazeltine et al. n.d.; Patterson et al. 1969). Another severe winter in 1889 devastated the Nevada cattle industry, and those operations that survived began providing winter feed to the cattle, a practice heretofore unknown in the West (Hazeltine et al. n.d., Sawyer 1971). Ever more complex land ownership patterns, water rights issues,

higher operating costs, diminished grazing lands, and increased government control prompted a gradual decline in local ranching. The national depression beginning in 1929, the closing of the Wingfield state banks, and the hard winter of 1931 marked the low ebb of ranching in Elko County (Patterson et al. 1969). Since that time, the industry has regained its footing, but the days of the large "Cattle King" operation appear over. Moderate scale corporate operations and small family ranches are more common.

4.7.6 PREVIOUS CULTURAL RESOURCE INVESTIGATIONS COMPLETED IN THE STUDY AREA

Records maintained by the BLM Elko District Office were reviewed to identify previous cultural resource studies conducted in the TSPP study area; those projects included in the BLM's files as of January 13, 1989 were reviewed. Files at the Nevada State Museum were consulted when project number or reference inconsistencies were encountered, and to locate records known to exist but not appearing in BLM archives.

The results of the archival review (presented in Appendix B of the Cultural Resources Technical Report) give the BLM project number, name and affiliation of the researcher, date of the research report, number of acres surveyed, number of sites recorded by survey, and report citation. In some cases, the reported project area extends beyond the present study area boundary. In such cases, sites recorded inside and outside the study area are segregated; the number of sites located outside the study area is presented parenthetically. Citations for reports listed are also included in this appendix.

A total of 46 investigations have been conducted entirely or partially within the TSPP study area. The earliest reported archaeological studies were by the Desert Research Institute in the Rock Creek area (Fowler 1968); further work did not occur until after establishment of the cultural resources section within the BLM in the mid-1970s. Subsequent archaeological work in the area has been performed in advance of projects proposed by the BLM or by others on BLM-administered lands. Generally small in scale, such projects have included powerlines, pipelines, well improvements, and oil and gas exploration work. Numerous other projects have been conducted by the Nevada Department of Transportation (NDOT) in association with highway improvements along U.S. 93 and I-80. More recently, several large inventories have been conducted in conjunction with the TSPP.

Prior studies have examined more than 21,389 acres, but not all of them lie in the study area. A review of maps showing study boundaries and locations relative to the present study area suggests that approximately 20,000 of the previously investigated acres are within the study area. Therefore, approximately 4 percent of the 661 square mile study area has been surveyed previously. Four surveys account for a majority of this acreage.

4.7.7 PROJECT ACTIVITY AREA SITE SUMMARY

Five TSPP activity areas have been identified: plant site, railroad route, three alternative access road routes, and one water pipeline route. Existing information at the BLM District Office in Elko, Nevada, the Nevada State Museum, and the Nevada State Historical Society, was reviewed to determine whether the activity areas or portions thereof had been studied previously, and whether cultural resources were known to be present within their confines. Summary results by activity area (110 square miles) of the review are provided in Table 4.7-1. This table also shows that little information is available for selected lands in the Snake Mountains. Few inventories of the areas have been conducted.

A total of 237 sites have been identified in the entire study area (661 square miles). Most, namely 215 sites or approximately 90 percent, are prehistoric in age and the remainder, namely 22 sites or approximately 10 percent, are assigned to the historic period. While site densities are variable across the landscape, the average density is one site in every 85 acres (Zeanah and Zeier 1989).

The majority of the prehistoric sites, 107, are isolated finds composed of one artifact. Surface scatters ranging in size from two to more than 500 artifacts constitute 91 of the sites. The site records indicate that 17 sites are considered eligible to the National Register by their recorder, while 175 are considered ineligible. The eligibility of 41 sites was recorded as uncertain, and no eligibility assessment of the remaining three sites was made (Zeanah and Zeier 1989).

Three rockshelters have been identified in the study area; at least two of these contain undisturbed cultural fill. Intact subsurface cultural deposits have been noted at 9 sites and are possibly present at three others. Projectile points were recorded at 56 sites, although type designations were not always given, and ceramics were identified at three sites. These chronological indicators allowed assignment of 51 sites to periods that indicate that Toano Draw has been occupied from Paleo-Indian to Post Formative times (Zeanah and Zeier 1989).

Of the 22 previously identified historic sites, two are related to the Emigrant Trail, six to railroading, two to mining, and three to ranching. Associations for the remaining nine are not clear. Three sites exhibited evidence of Chinese occupation or use. Sites associated with the Central or Southern Pacific Railroad include a section of original grade abandoned in 1903, the Fenelon station, two Chinese camps likely associated with 1869 construction of the line, and two small artifact scatters located adjacent to the line. Ranching is represented by a campsite, a horse corral, and an earthen dam. One site may represent a segment of the old Toano freight road, while another appears to have been a campsite occupied by emigrants (Zeanah and Zeier 1989).

Table 4.7-1 KNOWN CULTURAL RESOURCE SITES AND SURVEY ACTIVITY IN THE THOUSAND SPRINGS STUDY AREA AND PRIVATE LANDS PROPOSED FOR EXCHANGE

Activity Area	Number of Acres	Percent Previously Surveyed	Sites Recorded	Site Density (Sites:Acres)
Plant site	4,920	56.9	39	1:72
Railroad Route	6,200[a]	17.7	18	1:61
Proposed Access Road Route	9,152[a]	6.7	4	1:153
Alternative Access Road Route (Moor Summit)	13,700[a]	16.1	36	1:61
Alternative Access Road Route (Brush Creek)	8,200	6.7	4	1:138
Water Pipeline Route	11,200[a]	1.7	3	1:63
Selected Lands Proposed for Exchange	17,418	<0.01	4	1:25

[a] Acreages are derived from 1-mile-wide study areas.

In summary, Toano Draw exhibits a number of features that indicate it is an appropriate focal point of this archaeological inquiry. First, the study area possesses a rich archaeological record spanning 12,000 years of prehistory and history. A variety of prehistoric site phenomena occur there, including isolated finds, lithic scatters, rockshelters, antelope traps, open sites with buried deposits, and surface features. Historic site types include isolated finds, debris scatters, features, and structures. Prehistoric site distributions appear sensitive to temporal changes in subsistence and settlement patterns, while historic site distributions are sensitive to definable land use patterns.

These conditions notwithstanding, there are weaknesses in the Toano Draw data base in its present state. Knowledge of site distributions and site variability is based on numerous small-scale surveys conducted over a 20-year period. One hundred and sixteen sites were recorded during earlier inventories of offered lands (10,300 acres/16 sections). One hundred and nine of these were determined not to be elibible for listing on the National Register of Historic Places. Seven sites appear to have the potential to yield information important for understanding prehistory, but additional information will need to be gathered to make a final determination of eligibility. These surveys lack common research direction and have been approached with varying levels of expertise applying various data collection methods. Artifact typological assignments and counts have been undertaken during site recordation, with little subsequent verification based on detailed field studies, data recovery, or laboratory analysis. The surveys are biased toward alluvial flats in Toano Draw, so that comparatively little is known about prehistoric occupation of areas along Thousand Springs Creek, adjacent to upland springs, or in the pinyon-juniper woodlands.

These weaknesses limit the reliability of present statements regarding local prehistoric settlement patterns and occupation intensity, and historic land use patterns. Moreover, present site information exhibits considerable variations in level of detail, and in reliability of artifact and feature identifications. The reliability of site type designations is uncertain, in many cases. Thus, previous analyses of site distributions and occupational history must be viewed as tentative, untested hypotheses (Zeanah and Zeier 1989).

To address these deficiencies the BLM, in consultation with the Nevada State Historic Preservation Office would ensure that a Historic Properties Identification Plan be prepared by the applicant. The BLM would also ensure that a Historic Properties Treatment Plan be developed based on the results of the implemented Historic Properties Identification Plan to address the effects of the proposed project on historic properties. The details of these plans and responsible related agencies are discussed in Sections 5.7.2.4 and 5.7.3.

One additional Class III inventory (6980 acres) of the project lands has been undertaken since the literature search. On the exchange lands and

segments of rights-of-way that were inventoried, 220 new cultural resources were documented. A report addressing the character and value of these properties is presently being prepared. Evaluations of these resources, including statements regarding significance and National Register of Historic Places eligibility, will be included in that report. The information contained in that report will be included in the Final Environmental Impact Statement.

4.8 PALEONTOLOGICAL RESOURCES

4.8.1 STUDY AREA DEFINITION

The study area for the identification and assessment of paleontological resources is the same as that defined for the study of Geologic Considerations discussed in Section 4.3.1.

4.8.2 BASELINE DESCRIPTION

4.8.2.1 Selected Lands

The mountain ranges, including the Windermere Hills, Pequop Mountains, Gamble Ranges, and Ninemile Mountains, which surround the proposed TSPP consist primarily of Paleozoic and Mesozoic limestones with lesser dolomite and marine sediments.

In the eastern Windermere Hills to the west of the plant site, these rocks form the Black Mountain and Thousand Springs Sequences as described by Oversby (1972). The lower units of the Black Mountain Sequence contain some fossils including Devonian recrystallized coral, brachiopod, and stromatolite fragments and Mississippian crinoid stem fragments, stromatolites, and conodonts. The Thousand Springs Sequence is also somewhat fossiliferous containing Ordovician and Silurian graptolites, Devonian conodonts, Permian fusulines, Guadalupian brachiopods, and Triassic ammonoids. These fossils are neither rare nor unusual.

Tertiary volcanics and volcaniclastic sediments are exposed along the margins of Toano Draw. It is unlikely that significant paleontological resources exist in these units.

Surface materials within Toano Draw, including the plant site, consist of late Tertiary and Quaternary alluvial fan and channelized alluvial deposits. These deposits include fossiliferous limestone, siltstone, and mudstone clasts derived from the surrounding mountains.

Vertebrate fossils of unknown paleontological significance were recently discovered in Tertiary to Quaternary alluvial deposits in the vicinity of the Winecup Ranch. Additional information will be provided in the Final Environmental Impact Statement.

4.8.2.2 Offered Lands

Little has been written about the paleontological resources of the Snake Mountains. Oversby (1972) reports the stratigraphy of these mountains to be closely related to that of the Windermere Hills directly to the east. Therefore, the principal fossil-bearing rocks are contained within the Devonian to Mississipian Black Mountain and Ordovician to Triassic Thousand Springs Sequences. Fossils within the Black Mountain sequence include coral, brachiopod, stromatolite, and crinoid stem fragments, as well as conodonts. The Thousand Springs Sequence contains graptolites, conodonts, fusulinids, brachiopods, and ammonoids. These fossils are neither rare nor unusual.

Tertiary volcanics and volcaniclastic sediments and Quaternary alluvial sediments may contain fossiliferous clasts derived from the surrounding hills (Oversby 1972). However, the alluvium does not represent a significant paleontological resource.

4.9 VISUAL RESOURCES

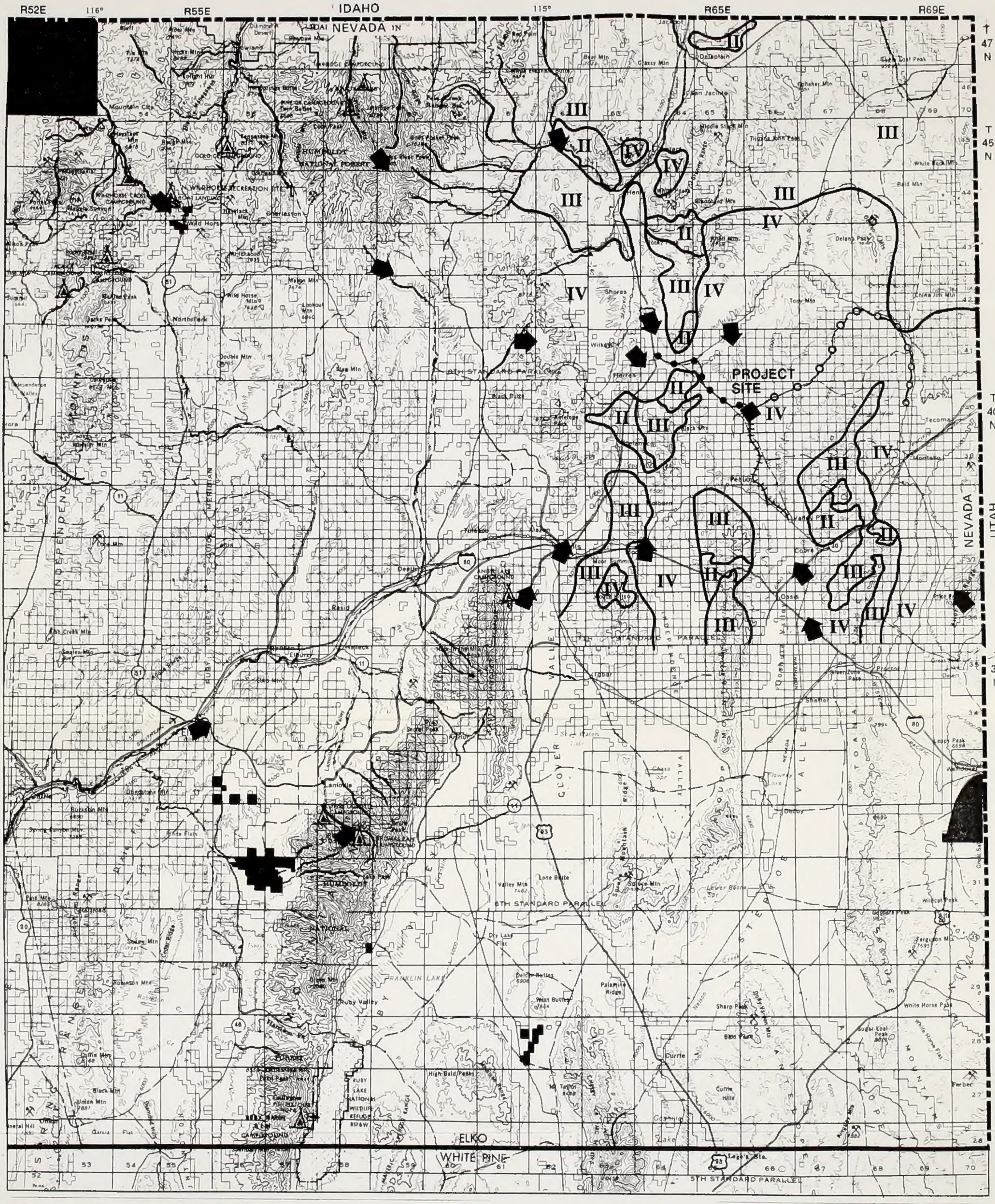
4.9.1 STUDY AREA DEFINITION

The objectives of the visual resources investigation were to identify, describe, and map significant visual resources which could be affected by the land exchange, construction, and operation of the proposed TSPP and alternatives. Visual resources are defined for this study as visually sensitive use areas where the maintenance of the surrounding visual environment is important to people's enjoyment or use of an area; and unique or unusual landscapes having natural scenic values. The study area is defined to include landscapes potentially affected by the proposed power plant and ancillary facilities including access alternatives, water pipeline, and solid and liquid waste disposal areas. The visual resource study was conducted in compliance with Federal guidelines established by the BLM Manual, Section 8400 Visual Resource Management (VRM) system and was designed to provide information suitable to assess the environmental consequences (direct and indirect impacts) of the proposed project and alternatives.

The visual resource baseline investigation has three major components: scenic quality, visual sensitivity, and distance zones. Existing information and maps compiled by the BLM Elko District Office were collected which described each of these components. BLM VRM classes derived from these three components were used to describe the extent or degree of visual modification allowed by BLM to an existing landscape scene. Figure 4.9-1 displays the VRM classes for the study area. Appendix A-1 is a glossary of visual resource terms commonly used throughout this report section.

4.9.2 METHODS

A visual resource investigation was conducted by BLM in compliance with guidelines in the BLM Manual, Section 8400, VRM. Appendix A-2 provides a



Source: Bureau of Land Management, Elko District. Visual Resource Management Class Map (verified 1989).

LEGEND

II, III, IV VRM classes

Key observation point

Railroad

Proposed access road

Water supply

0 10 20 miles

Figure 4.9-1. VISUAL RESOURCES VRM CLASSES

summary of the BLM VRM manual and worksheets. In 1980 the BLM Elko District resource specialists inventoried the scenic quality, visual sensitivity, and distance zones for the Wells Resource Area, Wilkins Valley Scenic Quality Rating unit, which contains the project area. These inventories were then compiled into VRM classes. The VRM classes are objectives by which visual resources of an area are managed. A numerical rating system is applied to distinguish classes. Each VRM class describes a different degree of modification allowed in the basic elements (line, form, color, and texture) of the landscape. Management classes are broken down into five levels (Classes I-V), with Class I designated the most protective of the visual resources. The inventory data were reviewed and portions were field-verified with the assistance of the BLM for accuracy and consistency during the winter of 1988.

The study area was defined by means of a generalized visual analysis of the relationship of TSPP, ancillary facilities, and alternatives to the surrounding topographic and vegetative patterns and potentially sensitive viewsheds (viewing points). The purpose of the analysis was to identify potentially significant obstructions or modifications of present views.

4.9.3 RESULTS

The TSPP project activities and facilities encompass approximately 1780 acres in northeastern Nevada. The landscape character by which scenic quality is judged is based upon descriptions in Fennenan (1931). The major physiographic province included in the study area is the extreme northern part of the Great Basin section of the Basin and Range Province.

The Great Basin is characterized by a rhythmic pattern of mountain ranges and basins. Isolated, irregularly-shaped, block-faulted mountain ranges average 50-75 miles in length and are separated by aggraded desert plains and broad basins. The TSPP site is located on the Toano Draw valley plain which feeds into Thousand Springs Basin. Mountains which bound the site are the Snake Range and Windermere Hills to the west, Pequop Range to the south, Knoll Creek and Granite Ranges to the north, and Delano and Murdock Ranges to the east. Elevation of the valley plain varies from 5500 to 5700 feet and surrounding mountain ranges vary from 8200 to 8700 feet.

Vegetation can be characterized as being largely distributed in homogeneous patterns. In the valley basins vast areas of sagebrush are occasionally broken up with areas of scattered grasslands. Some areas have fence lines separating grasses and sagebrush. Infrequent linear patterns of riparian vegetation arrangements of willow and cottonwoods highlight the larger drainages. The foothills and mountains contain a cover of scattered piñon-juniper forest. The forest pattern is mottled; however, more dense patterns are located along upland saddles and draws. Mixed shrubs are located along intermittent drainages of higher elevations.

Portions of the landscape have been culturally modified. Most prominent modifications occur on the irrigated meadowlands along Thousand

Springs and Toano Draw. The Winecup Ranch, irrigation wells, and a network of roads criss-cross the Toano Draw and Thousand Springs Creek area. An abandoned partially burned structure is found at Wilkins. West of U.S. Highway 93 is a north/south-oriented 138-kV wood pole transmission line.

Clear skies with high visibility and broad open landscapes characterize the study area's regional landscape setting including the TSPP site. Maintenance of visual resources is consequently of special concern, including views from Federal lands with high visual resource values, Federally designated wilderness areas, park and recreation areas and trails, major transportation routes, and population centers. As a whole, the region contains some relatively uniform scenery, with isolated incidents of high scenic interest, mainly concentrated around mountain ranges and bodies of water such as lakes, reservoirs, or rivers.

Major viewing locations and key observation points were identified. These points, which include communities, travel routes, and park and recreation areas, are displayed on Figure 4.9-1. The larger towns and communities, such as Elko and Wells, provide permanent and high-frequency viewing opportunities for residents. Most visitors to the region view the study area's landscape from relatively few major travel routes. Several state highways and county roads crisscross the basins of the study area. Below is a breakdown of viewing locations and points of concern identified for the study area.

- <u>Travel Routes</u> - US Highway 93, Winecup Road, Amtrak Southern Pacific east-west line, State Route 233, and Interstate 80
- <u>Communities</u> - Wells and Elko
- <u>Park and Recreation Areas</u> - Ruby Mountains Scenic Area and National Recreation Trail, Snake Range, Pilot Peak, East Humboldt Wilderness Area, Jarbidge Wilderness Area, Wildhorse Recreation Area, Badlands Wilderness Study Area, and Mary's River.

The TSPP site is designated Class C scenic quality, low to moderate visual sensitivity, and background distance zone from most viewing points. The BLM inventory has rated the vicinity of the TSPP and surrounding valley plain VRM Class IV. Under BLM guidelines, the objective of this class is to allow for management activities which may involve major modification of the existing character of the landscape. These management activities may dominate the view and be the major focus of viewer attention. However, the guidelines state that every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

4.10 <u>RECREATIONAL RESOURCES</u>

The purpose of the recreational resources investigation is to identify and describe major recreational resources in the vicinity which may be

affected by the land exchange, construction, and operation of the proposed TSPP project and alternatives. The investigation also examines the effects the proposed project could have on existing and planned recreational opportunities. The data were gathered in sufficient detail to be used in assessing direct and indirect impacts on recreational resources from the proposed action and alternatives.

The following types of recreational resources are described:

- Recreation attractions within the regional setting
- Developed recreation sites
- Dispersed recreational activities (including hunting and fishing)
- Community recreation facilities

4.10.1 STUDY AREA DEFINITION

The recreational resources study area for this project extends from the Jarbidge Mountains to the northwest, the Ruby Mountains to the south, and small reservoirs (e.g., Dake, Crittenden, and Boies) and streams (e.g., Mary's River, Salmon Falls Creek) to the north and east. Local recreationists frequently drive 100 miles or more to surrounding recreation areas for weekend and day use. The most common forms of recreation tend to concentrate around special scenic or recreation features, facilities, or travel routes. In the project vicinity, recreation use or demand is low and generally dispersed. Major activities include camping, hunting, fishing, and sightseeing. Table 4.10-1 provides an assessment of recreation facilities and areas in the study area. Figure 4.10-1 displays these recreation facilities and areas.

The Nevada Statewide Comprehensive Outdoor Recreation Plan (SCORP) has identified the study area as Planning Region V (Elko County). According to the 1987 SCORP for Elko County, the majority of demand by county residents for recreation facilities has been supplied. However, fishing areas and hiking and backpacking trails presently indicate that demand exceeds the capacity of available areas. Table 4.10-2 is a summary of supply, demand, and need. According to the SCORP, these data do not reflect the use by nonresidents of the county.

4.10.2 DATA COLLECTION METHODS

Recreational resource information was compiled from maps and existing literature provided by public and private agencies. Data sources for the baseline inventory included published information from the Humboldt National Forest, Elko District BLM, Nevada Department of Wildlife, and Nevada Department of Conservation and Natural Resources, Division of Parks. Several of these agencies also supplied pertinent documents and maps. U.S. Geological Survey 7.5 minute topographic quadrangle sheets (Scale 1:24,000), BLM surface management quads (Scale 1:100,000), BLM public land guide maps (Scale 1:500,000), and the SCORP were also examined. The baseline data were supplemented by information provided in

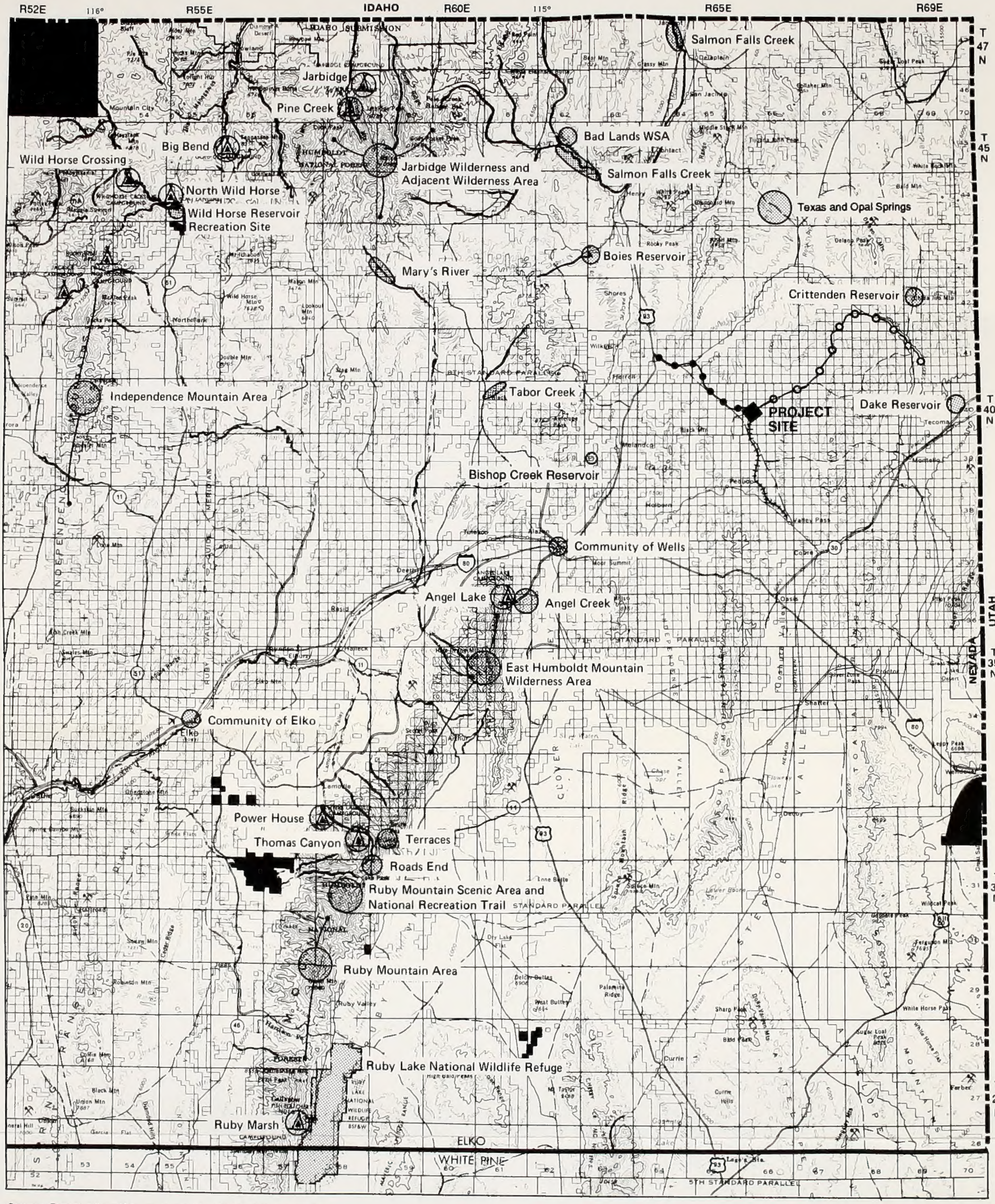
Table 4.10-1. EXISTING RECREATION AREAS AND FACILITIES, THOUSAND SPRINGS PROJECT

Area or Facility	Jurisdiction[a]	Proximity from TSPP (miles)[b]	Camping	Picnicking	Sightseeing	Fishing	Birdwatching	Hunting	Swiming	Float Boating	Backpacking	Rock Hounding	Hiking	Comments
Ruby Marsh Campground	USFS	100	•	•	•	•	•						•	50,000 visitor days/year. Major fishing area. 35-unit campground
Tabor Creek	BLM	25	•	•	•	•	•	•						
Salmon Falls Creek	BLM	40	•	•	•	•	•	•	•	•	•		•	Major dispersed recreation area
Crittenden Reservoir	PVT/NDOW	20			•	•	•	•		•				Quality trout fishing
Mary's River	BLM/PVT	45	•	•	•	•	•	•	•				•	
Bishop Creek Reservoir	BLM/PVT	17				•								Reservoir is dry
Texas and Opal Springs	BLM/PVT	20	•	•				•				•	•	Popular rock collecting area
Dake Reservoir	PVT	25				•	•	•		•				
Boies Reservoir	PVT	25		•		•	•			•				
Angel Lake	USFS	42	•	•	•	•	•	•	•	•	•		•	26-unit campground, 11 picnic sites
Angel Creek	USFS	40	•	•	•	•	•	•					•	18-unit campground, 1 picnic site
Wildhorse Crossing	USFS	75	•	•	•	•		•					•	37-unit campground, 11 picnic sites
Wildhorse Recreation Site	State/BLM	70	•	•	•	•	•	•	•	•			•	Wildhorse Campground is owned by BLM but operated by the State
Big Bend	USFS	67	•	•	•	•		•					•	15-unit campground
Pine Creek	USFS	56	•	•	•	•		•					•	6-unit campground
Jarbidge Campground	USFS	60	•	•	•	•		•					•	5-unit campground
Ruby Crest Trail	USFS	70	•	•	•	•	•	•			•		•	
Ruby Mountain Scenic Area	USFS	70	•	•	•	•		•					•	
Roads End	USFS	66		•	•						•		•	Trail head to Ruby Crest Trail, 2 picnic sites
Terraces	USFS	70	•	•	•						•		•	Trail Head to Ruby Crest Trail, 9-unit campground
Power House	USFS	68		•	•	•		•					•	5 picnic sites
Thomas Canyon	USFS	68	•	•	•	•		•					•	42-unit campground
Ruby, Independence, and Jarbidge Mountain Ranges	USFS	50-80	•	•	•	•	•	•			•		•	Excellent mule deer hunting
Ruby Lake National Wildlife Refuge	USFWS	90		•	•		•			•			•	85,000 visitor days of use/year
Jarbidge Wilderness Area	USFS	50	•	•	•	•	•	•			•		•	13,000 visitor days of use/year
Badlands WSA	BLM	40	•	•	•			•		•	•		•	

[a] Jurisdiction:
BLM - Bureau of Land Management
USFS - U.S. Forest Service
USFWS - U.S. Fish and Wildlife Service
NDOW - Nevada Department of Wildlife
PVT - Private
State - State of Nevada Lands

[b] All mileages are air miles, not road miles

Source: Bureau of Land Management, Elko District Office, Map Files; U.S. Forest Service, Humboldt National Forest, Map Files



Source: Bureau of Land Management, Elko District Office, Map Files.
U.S. Forest Service, Humboldt National Forest, Map Files.

LEGEND

Railroad

Proposed access road

Water supply

Recreation site/area

Recreation area

Public campground

0 10 20

miles

N

Figure 4.10-1. RECREATIONAL RESOURCES IN THE STUDY AREA

Table 4.10-2. SUMMARY OF SUPPLY, DEMAND, AND NEED FOR RECREATION IN ELKO COUNTY FROM 1986 TO 2000

	1986	1990	1995	2000
Fishing, Stream - Miles of Stream				
Demand	65	73	81	90
Supply	11	11	11	11
Need	54	62	70	79
Swimming - Number of Pools				
Demand	3	3	3	4
Supply	4	4	4	4
Need	0	0	0	0
Skiing, Crosscountry - Miles of Trail				
Demand	16	17	18	21
Supply	0	0	0	0
Need	16	17	18	21
Skiing, Downhill - Acres of Skiing				
Demand	7	7	8	9
Supply	0	0	0	0
Need	7	7	8	9
Bicycling - Miles of Trail				
Demand	22	24	28	31
Supply	2	2	2	2
Need	20	22	26	29
Camping, Tent - Number of Sites				
Demand	229	255	283	315
Supply	397	397	397	397
Need	0	0	0	0
Picnicking - Number of Tables				
Demand	78	98	96	107
Supply	207	207	207	207
Need	0	0	0	0
Hiking/Backpacking combined - Miles of Trail				
Demand	26	28	31	34
Supply	7	7	7	7
Need	19	21	24	27

Table 4.10-2. SUMMARY OF SUPPLY, DEMAND, AND NEED FOR RECREATION IN ELKO COUNTY FROM 1986 TO 2000 (concluded)

	1986	1990	1995	2000
Baseball/Softball - Number of fields				
Demand	11	12	14	16
Supply	10	10	10	10
Need	1	2	4	6
Golf - Number of nine-hole courses				
Demand	3	3	3	3
Supply	2	2	2	2
Need	0	0	0	0
Tennis - Number of Courts				
Demand	10	12	13	15
Supply	10	10	10	10
Need	0	2	3	5

Source: Nevada Department of Conservation and Natural Resources (1987)

meetings and telephone contacts with Federal, state, county, and community recreation and land management agencies. Baseline information was verified by ground reconnaissance during the winter of 1988.

4.10.3 BASELINE DESCRIPTION

Below is a brief description for regional recreation, developed recreation sites, dispersed recreational activities, and community recreation facilities in the study area.

4.10.3.1 Regional Recreation

Major regional recreational resources include the Ruby Mountains, the East Humboldt Mountains, Ruby Lake National Wildlife Refuge, Wildhorse Reservoir State Recreation Area, and Jarbidge Wilderness Area. Hunting and fishing opportunities exist regionwide and are described in Section 4.10.3.5.

Ruby Mountains and East Humboldt Mountains. The 700,000-acre Ruby Mountains contain scenic or special attraction areas including the 40,000-acre Ruby Mountain scenic area. This area is characterized by steep rugged-sloped mountain peaks and alpine lakes providing opportunities for many forms of outdoor recreation. Hiking, fishing, hunting, sightseeing, backpacking, and camping are favorite activities of the area. Four campgrounds are easily accessible including Angel Creek and Angel Lake in the East Humboldt Range, and Thomas Canyon and Terraces in the Ruby Mountains. The 40-mile Ruby Crest National Recreation Trail winds through the scenic area representing a portion of the approximately 300 miles of hiking and backpacking trails in the Ruby Mountains Ranger District of the Humboldt National Forest. Total visitation of these areas was estimated at 2,400,080 visitor hours/year in 1986 and estimates for 1989 were 3,607,000.

Ruby Lake National Wildlife Refuge. Located at the eastern base of the Ruby Mountains is the 37,600-acre Ruby Lake National Wildlife Refuge. The refuge is a major waterfowl nesting area for Pacific and Central Flyways bird migration corridors. USFS manages a campground which receives high use. Over 268,000 visitor hours/year were estimated in 1986 for the campground with about a third of the users from Elko County. In 1989, 435,240 visitor hours/year were estimated, with about a third of the users from Elko County. The recreation activities include fishing, picnicking, wildlife observation, sightseeing, hunting, and hiking. The National Wildlife Refuge has an annual estimate of 85,000 recorded visitors, two-thirds of whom are from Elko County.

Wildhorse Reservoir Recreation Area. Wildhorse Reservoir Recreation Area is located on the Owyhee River 65 miles north of Elko. This area covering 120 acres contains recreational opportunities for sightseeing, fishing, hunting, watersports, and camping. This area has a 33-unit campground controlled by the state and an 18-unit North Wildhorse Campground administered by the BLM. This 2830-acre reservoir, when full, is the largest in the county. Estimated visitor use has ranged from 128,000-

192,000 visitor hours/year. The wide fluctuation of use is due primarily to recent summer drought conditions.

South Fork State Park. A state-administered reservoir and recreation area, South Fork is located southwest of Elko. A 25-unit campground is scheduled for construction in 1990-91. Estimated visitor use is planned for approximately 50,000-100,000 visitor days/year.

Jarbidge Wilderness Area. Jarbridge Wilderness Area located in northern Elko County, approximately 120 miles by road, covers 113,500 acres. Designated wilderness in Nevada in 1964 and enlarged in 1989, the area attracts visitors from in and out of state for a 2- to 3-day average trip. Over 125 miles of hiking trails are contained in Jarbidge Wilderness Area. Activities include fishing, hiking (125 miles), backpacking, sightseeing, picture taking, hunting, and camping. Use is estimated at 16,400 visitor days/year in 1989 (Humboldt National Forest 1989).

4.10.3.2 Developed Recreation Sites

In addition to the regional recreation sites discussed above, there are several other developed recreation sites in the study area. Tabor Creek is located 25 miles west of the plant site. BLM maintains the area as a primitive recreation site and picnic area. The area is heavily used as a base camp for big-game hunting. The USFS operates and maintains a number of campgrounds in the study area in addition to those described previously. These include Jarbidge, Pine Creek, Big Bend, and Wildhorse Crossing campgrounds located in the Jarbidge Mountains. The USFS maintains additional areas in the Ruby Mountains, i.e., Roads End picnic area and Terraces and Thomas campgrounds, and trailheads to the Ruby Crest Trail. The USFS also operates Angel Lake and Angel Creek campgrounds in the East Humboldt Range.

4.10.3.3 Dispersed Recreation

There is a wide range of dispersed water-based recreational opportunities in the study area (e.g., fishing, floatboating). Elko County supplies 15 percent of the state's fishing, 24 percent of the hunting, and 11 percent of the primitive camping and backpacking. The county also contains 46 fishing reservoirs (35 percent of the statewide total).

Salmon Falls Creek contains a 16-mile segment which provides opportunities for fishing, canoeing, floatboating, swimming, camping, backpacking, and sightseeing. BLM has identified Salmon Falls Creek as a special recreation management area and plans for development are currently being completed. Development will include boat launching facilities and a small campground. A primitive recreation site along the upper portion of the creek contains opportunities for fishing and camping. Badlands Wilderness Study Area covers 9400 acres and contains outstanding sightseeing and hiking opportunities. A 26-mile segment of the Mary's River provides fishing opportunities. Crittenden Reservoir (20 miles northeast of the plant site) is managed by the Nevada Department of Wildlife as a quality trout fishery. Other dispersed recreation opportunities include

Bishop Creek, Dake, and Boies Reservoirs located 17 miles west, 20 miles east, and 25 miles northwest of the plant site, respectively. Approximately 20 miles north of the plant site, the areas of Texas and Opal Springs are frequented for rock collecting. Elko County contains 250 rivers and streams totaling 2673 miles according to the SCORP. Of these, 221 are fishing streams (41 percent of the statewide total).

4.10.3.4 Community Recreation Facilities

Wells contains one park, one swimming pool, two ballfields, one golf course, one bike path, one trap range, one race track, and one rodeo arena. Elko has two golf courses, three parks (totaling 120 acres), two soccerfields, one archery range, one speedway, one pistol and rifle and trap, horse track, and skeet range, six ballfields, two swimming pools and one wading pool, ten tennis courts, three gymnasiums, two bowling alleys, and one bike path. The ratio of acres of recreation facilities per capita for Wells is 0.169, and for Elko is 0.0262. Ratios in the other potentially affected communities of Twin Falls, Jackpot, and Wendover are 0.0201, 0.149, and 0.117, respectively.

4.10.3.5 Hunting

Hunting is a significant recreational activity in the study area. Elko County is known for quality hunting. The public lands in and around the Jarbidge, Independence, and Ruby Mountains, as well as the O'Neil Basin, Goose Creek, and Dairy Valley areas, are considered the most productive and popular hunting areas in the region. For 1988, the controlled general hunting season for deer included 35,175 buck tags available statewide, of which 17,371 tags (49 percent) were available in Elko County. A total of 18,187 doe tags were available statewide in 1988, of which 10,172 tags (56 percent) were available in Elko County. From 1982-1987, the hunting success rate for mule deer in Elko County has averaged approximately 60 percent. The number of tags varies from season to season depending upon the size of the herds.

The number of trophy game tags issued for elk statewide in 1988 was 79, 8 for Elko County (10.1 percent); 1988 antelope tags available statewide was 1262, 147 for Elko County (16.0 percent); and mountain lion tags statewide was 217, 38 for Elko County (17.0 percent). Approximately 30-40 percent of the statewide sage grouse harvest is in Elko County. There are unique hunting opportunities within the state which only occur in the Elko County region. Two tags are issued for Rocky Mountain goats in the Ruby Mountains. Additionally, Himalayian snowcocks, an introduced game bird species, are hunted in the Ruby Mountains. Overall, based on 1988 survey data, approximately 44 percent of the total mule deer hunter days statewide occur in Elko County.

4.10.3.6 Off-Road Vehicle Activity

According to BLM, the study area has a relatively low level ofoff-road vehicle (ORV) activity, particularly in the vicinity of the plant site,

primarily because of its isolated location. No information is available on ORV use activity in the study area.

4.11 SOCIOECONOMICS

4.11.1 STUDY AREA DEFINITION

Eight communities are located within 100 road miles of the proposed plant site. Five of these were reviewed for analysis. Elko and Wells, Nevada, have the greatest potential for impacts from the proposed action and alternatives and, therefore, are analyzed in detail. A less detailed analysis of Jackpot and Wendover, Nevada, and Twin Falls, Idaho is provided in Sections 4.11.2.7 and 5.11.1.7. This analysis is less detailed because these communities are anticipated to receive fewer impacts. Jackpot and Wendover are relatively small, distant from the project site, and would likely not attract a significant number of workers. Twin Falls is a relatively large city that would have little difficulty in accomodating project workers and families. A more detailed description of study area definition and socioeconomic impact analysis is provided in the Socioeconomics Technical Report, Section 1.0. Information for the analysis was provided by local agency personnel, a socioeconomic gravity model, and the Electric Power Research Institute (EPRI) studies of power plants. Figure 4.11-1 shows the communities located within 100 miles of the proposed plant site.

4.11.2 BASELINE DESCRIPTION

4.11.2.1 Population

Recent population growth in Elko County is associated with gold mining in the Carlin Trend and has occurred mainly in the incorporated areas of Carlin and Elko. Workers and their families emigrated to the area for jobs associated with the mining and mill construction. The population of the City of Carlin doubled in the last 1.5 to 2 years, primarily as a result of gold mining and associated services (Trousdale 1989).

Elko County's population increased by 7730 residents to approximately 25,000 between 1980 and 1987. This represents the largest population gain by any rural county in Nevada during this period (State of Nevada 1988). Population estimates and projections for Elko County are made by different agencies and often differ. The 1988 population estimates range from 26,790 (Nevada Department of Taxation) to 28,917 (Elko County) and already exceed University of Nevada-Reno's projection of 26,290 for the Elko County population in 1990.

Elko County has a substantially higher percentage of American Indian residents than the State of Nevada as a whole (8.5 percent vs 1.6 percent), and a somewhat higher percentage of residents of Hispanic origin (10.7 percent vs 6.7 percent) (State of Nevada 1988).

City of Elko. The estimate of Elko's 1988 population made by the Nevada Department of Taxation is 14,620 (Nevada Department of Taxation 1988).

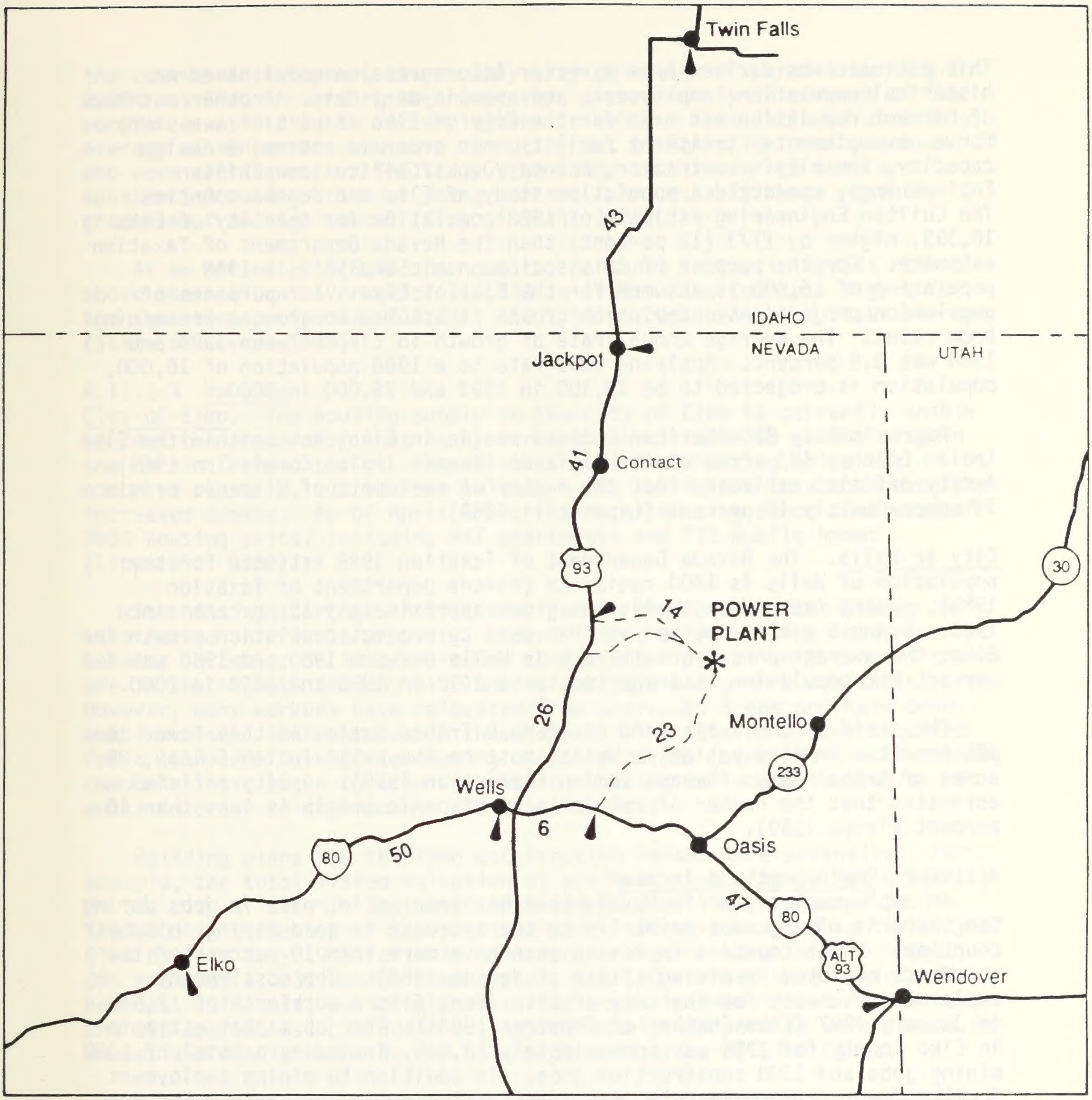


Figure 4.11-1. COMMUNITIES WITHIN 100 MILES OF PLANT SITE

This estimate was derived from a vector autoregression model based on historical population, employment, and unemployment data. Another estimate of current population was made for the City of Elko as part of a a study for a new wastewater treatment facility. In order to determine design capacity, the city's contractor, Kennedy/Jenks/Chilton (now Chilton Engineering), conducted a population study of Elko and Eureka counties. The Chilton Engineering estimate of 1988 population for the City of Elko is 16,393, higher by 1773 (12 percent) than the Nevada Department of Taxation estimate. For the purpose of this socioeconomic analysis, a 1988 population of 16,000 is assumed for the City of Elko. For purposes of population projections, population growth is assumed to grow at pre-mining boom rates. The average annual rate of growth in Elko between 1980 and 1986 was 3.8 percent. Applying this rate to a 1988 population of 16,000, population is projected to be 19,300 in 1993 and 25,000 in 2000.

Approximately 800 American Indians reside in Elko, most within the Elko Indian Colony, 192 acres of tribal lands (Nevada Indian Commission 1989). A city official estimates that the number of residents of Hispanic origin is approximately 10 percent (Lipparelli 1989).

City of Wells. The Nevada Department of Taxation 1988 estimate for the population of Wells is 1400 residents (Nevada Department of Taxation 1988). Using these data, Wells has grown approximately 15 percent since 1980. Using a similar method as that used to project population growth for Elko, the average annual growth rate in Wells between 1980 and 1986 was 1.3 percent and population is projected to be 1490 in 1993 and 1630 in 2000.

The staff of the Wells Band of Te-Moak Tribes estimates that fewer than 100 American Indians reside in Wells, most on the Wells Indian Colony, 80 acres of tribal lands (Nevada Indian Commission 1989). A city official estimates that the number of residents of Hispanic origin is less than 10 percent (Tripp 1989).

4.11.2.2 Employment and Income

An employment sector in Nevada that has seen an increase in jobs during the 1980s is mining, due primarily to the increase in gold mining in many counties. Eight counties in Nevada each have more than 10 percent of the workforce employed in mining (State of Nevada 1988). The most recent employment estimate for the City of Elko identifies a workforce of 12,940 in January 1987 (Elko Chamber of Commerce 1988). The job market estimate in Elko County for 1989 was approximately 13,020, including a total of 1050 mining jobs and 1300 construction jobs. In addition to mining employment in Elko County, approximately 2630 additional miners commute from the Elko area to mines located out of the County (North East Nevada Development Authority [NENDA and SPR] and Sierra Pacific Resources [SPR] 1989). The estimated number of unemployed persons in Elko County in July 1989 was 800, for a seasonally adjusted unemployment rate of 6.3 percent (Clarke 1989).

The City of Wells conducted an employment survey in September 1988 which described employment from October 1987 through September 1988. Over

the course of that year, the monthly average number of persons working in Wells was 504. According to the survey, approximately 10 percent of the workforce was available for employment in Wells. This included a monthly average of 42 persons who were commuting out of Wells for employment and 14 who were seeking work. The study also found that there has been a substantial outmigration of young workers, particularly those recently graduated from high school (City of Wells 1988).

At an estimated $15,445 per capita, personal income in Nevada ranked above the national average of $14,636 in 1986. Elko County's figure for the same time period was $13,421, about 15 percent below the state average (State of Nevada 1988).

4.11.2.3 Housing

City of Elko. The housing supply in the City of Elko is currently unable to meet the demand for housing by workers associated with gold mining in the Carlin Trend district. Rapid construction of housing units has occurred recently, but the new units are not sufficient to accommodate the increased demand. As of April 1988, the total housing stock consisted of 3883 housing units, including 947 apartments and 736 mobile homes (Lipparelli 1988).

The housing shortage in 1988 resulted in people with jobs living in cars parked on private property, Federal land, or in parking lots; in motels; in tents; or in overcrowded conditions. Rental units and RV spaces are in the highest demand, with houses for sale being more available. However, many workers have relocated from depressed areas and have been unable to sell their houses in those areas. The waiting period required for a loan adds further to housing market problems (Lenz 1988). The mining companies have begun to acquire existing housing units and to develop new units in order to accommodate their new workers.

Building plans for the 1988 construction season were extensive. For example, the total listed valuation of projects receiving building permits in the City of Elko in September 1988 was $4.6 million, compared to $813,600 in September of the previous year. Plans submitted to the City of Elko by late July 1988 for that construction season were for 256 houses, 256 apartments, 238 mobile home spaces, and 140 recreational vehicle (RV) hookups. Of these, building permits had actually been issued for 21 houses and 128 apartments. In addition, approximately 120 permits were issued for houses and mobile homes in the unincorporated areas of Elko County.

Planned housing developments involve public hearings where conditional use permits are required or if the development is a subdivision. In Elko in 1988, specific recent projects in the permit approval process included:

- 80 additional apartments near the 128 existing apartments planned by a division of Newmont Gold Company

- 18-unit and 30-unit apartment complexes by Group West Development
- 152 mobile home spaces at Southgate Mobile Home Park
- 86 mobile home spaces at Sage Hills II
- 89 homes in 1988 and 110 in 1989 in the Mountain View Estates, planned by Barrick Goldstrike Mines
- Development of 195 lots in the Bluff's subdivision in phases of about 10 units, by the Great Basin Partnership

Most of these units had been constructed by the beginning of 1989. A brief housing moratorium was lifted when Elko committed to building the sewer system percolation ponds, and 168 single-family units, 112 apartments, and 61 RV spaces were permitted between April 1 and August 9, 1989. In addition, 18 single-family units, 163 apartments, and a 61-unit motel received building permits in August 1989 but cannot receive occupancy permits until Phase I of the sewer project is complete (Windburn 1989).

As of September 1989, city and county officials believed that the recent construction growth is accommodating the workers associated with the gold mining boom (Boucher 1989; Lippareli 1989).

For the purpose of this analysis, the number of housing units in Elko in late 1989 is 5200, including those planned for construction. Using the existing average household size of 3.3, an additional 1000 units will need to be built by 1993, and an additional 2700 units by 2000, to accommodate the projected additional population.

City of Wells. The current number of housing units in the City of Wells is estimated to be around 500. In February 1987, the city conducted what is informally known as a "windshield survey" in order to count the number of existing housing units. A total of 471 households was counted, with 394 appearing occupied and 77 appearing vacant, yielding a vacancy rate of 16 percent. The city also conducted an employment survey in September 1988 and the surveyors contacted 395 households. Currently, there are few vacancies in the City of Wells (Yan 1989).

A survey of the number of rental units in the City of Wells and the occupancy rates was conducted in March 1989. The survey reported 166 rental units, including 47 apartments, 4 homes, 21 trailers, and 94 trailer spaces. The occupancy rate in the summer months was 95 percent but dropped to 62 percent in the winter months (Tripp 1989).

There are fifteen hotels and motels (with a total of approximately 400 units) in the City of Wells. The motels are almost fully occupied during the summer but have rooms available in the winter months. Daily room rates are approximately $15 for the hotels and range from $21 to $32 for the motels (Tripp 1989).

Private developers have been formally proposing housing developments in Wells. The city has created a 66-lot subdivision complete with sewer and water services. In Spring 1989, the Wells City Council approved a 120-space mobile home park adjacent to a planned industrial park. However, the approval of the mobile home park is contingent on the development of sewer service, stormdrains, and access roads to the industrial park, which would serve the mobile home park. Detailed descriptions of utility service improvements are provided in Sections 2.4.6 and 2.4.7 of the Socioeconomics Technical Report.

The city has several parcels available for development. They are proposing to move the rodeo ground (8.4 acres) and chariot race track (approximately 75 acres) to a public recreation area just south of the city limits. In addition, the city has had discussions with the BLM to reserve two ¼-sections (approximately 150 acres) just west of the city limits as residential (Dunn 1989).

Based on the existing average household size of 2.8 persons, the City of Wells will require 30 more housing units to serve additional population by 1993 and 80 additional units by 2000.

4.11.2.4 <u>Community Services</u>

<u>Schools</u>. The Elko County School District currently consists of five elementary schools and eight secondary or combined (elementary and secondary) schools. The enrollment in these schools has greatly increased in the past few years, associated with growth in mining and related industries and casino jobs. Enrollment in the district as a whole increased almost 16 percent from the 1987-1988 school year to the 1988-1989 school year and almost 50 percent in the previous 5 years. The elementary schools had the largest increase from 1987-88 to 1988-89 (493 students or 2.3 percent increase) (Knight 1988).

<u>City of Elko</u>. The City of Elko has five elementary schools, a junior high, and a high school. The number of elementary students in the City of Elko increased by 412 between 1988-89 and 1989-90. However, enrollment in Southside, Grammar School #2, and Northside Elementary Schools has decreased in the past year, with the opening of Mountain View and Spring Creek (Phase I) Elementary Schools. Phase II of Spring Creek Elementary School opened in January 1989. Southside Elementary School has a capacity of 700 and a current enrollment for 1989 of approximately 700. Six classrooms were added for the 1989-1990 year. Grammar School #2 has an enrollment of 452, approaching its capacity of 500. It is not possible to add trailers to this school site. Northside Elementary School has a current enrollment of 510, below its capacity of 600, having lost students to the new elementary schools. Mountain View Elementary School, opened in April 1988, consists of 12 relocatable trailers, four of which were added for the 1989-1990 school year. The current enrollment is 530, with a capacity of approximately 600. Spring Creek Elementary School opened in September 1988 with an enrollment of 430. Phase II of this school opened in January 1989 with an enrollment of 710, already greater than the

capacity of 600. Six classrooms were added for the beginning of the 1989-90 school year and two more classrooms are planned for October 1989. Current enrollment at Spring Creek Elementary is 835, with class sizes of 31-32 (Billings 1989).

Elko Junior High School, which includes grades 7 and 8, is currently at its capacity of 600 in 1988-89. Six classrooms were added at the beginning of the 1989-90 school year and two more classrooms are planned for October 1989. Current enrollment at the Junior High is 730. The current enrollment of Elko Senior High School is 1233, which is below the schoolroom capacity of 1500. However, the school is at capacity in vocational and science areas (i.e., auto shop, welding, drafting, electronics, construction, business, home economics, surveying, etc.) (Knight 1988).

City of Wells. The school in the City of Wells is a combined school, which includes the elementary and secondary school. The elementary school (K-8) is currently (1988) at capacity with an enrollment of 302. Available capacity exists at the secondary level, which has a current enrollment (1989-90) of 130 and has a capacity of 300. The school has 21 relocatable trailers, each with two classrooms. There is space available to accommodate more relocatable trailers for the elementary school (Knight 1988).

Enrollment Projections. To estimate growth in school enrollment associated with non-project-related growth in Elko and Wells, current ratios of students to population were applied. On this basis, the projected enrollment for Elko will increase from the 1989-90 enrollment of 4995 to 5951 in 1993, 7336 in 2000, and 10,273 in 2007. The projected enrollment in Wells will increase from 432 currently (1989-90) to 458 in 1993, 499 in 2000, and 565 in 2007. Elko County School District will need to add classrooms and schools to accommodate this growth because available capacity does not exist.

Funding. The Elko County School District receives monies from several sources. The approximate current breakdown of funding sources is state (52 percent), Federal (10 percent), and local (38 percent). Revenue is received from the State Distributive School Fund, based on the number of students in the school district. This money is supplemented by ad valorem taxes. In addition, the district receives Federal assistance under Public Law 81-874. These monies combine to form the General Fund which supports operating costs (D. Harris 1989).

The Elko County School District also receives revenue for the Capital Projects Fund. This revenue is derived from a portion of the ad valorem tax and money generated by the Motor Vehicle Privilege Tax, which is collected as part of vehicle registration in the state. The Capital Projects Fund may be used for projects such as renovations, roof replacements, or construction of new schools.

Law Enforcement. The Elko County Sheriff's Department is located in the City of Elko and employs 20 road officers and has approximately 15 vehicles. In Spring 1989, Sheriff Jim Miller requested that Elko County provide funding for an additional five officers, due to an increase in crime in Elko County in the last year (Tilley 1989).

Nevada highway patrol operates a regional office at Elko and three unnamed substations at Wells, Jackpot, and Wendover. The regional office at Elko comprises one sergeant and four troopers. There is a resident sergeant and two troopers at Wells. There are two resident officers based in Wendover and one at Jackpot. Response time in the study area is about 1 minute a mile, and would be longer if the officers are off duty at the time of the emergency (Kendall 1989).

City of Elko. The City of Elko police department consists of 25 police officers and reserve officers, a police chief, an animal control officer, and six sheriff's officers. The department has funding for three additional officers in July 1989. The police station is adequate in size as a result of the department's recent move into a new building (Forbes 1988). The service ratio of 31 officers to a current population of 16,000 is equal to 1.9 officers for each 1000 residents. A typical service ratio is 1.5 to 2.0 officers for 1000 residents (Leistritz and Murdock 1981). The service ratio would be 1.6 in 1993 and 1.2 in 2000 if additional officers are not hired to correspond to the projected increase in population. The city would need to hire 6 officers by 1993 and 17 officers by 2000 to maintain the current service ratio.

City of Wells. The City of Wells employs five full-time officers and one Elko County Sheriff's Deputy. The number of full-time officers is the minimum number required to offer 24-hour protection. The department also has four paid reserve officers to fill vacancies (Dunn 1988). The current service ratio is 4.3 officers for each 1000 people, which is substantial coverage. This would decrease to 4.0 in 1993 and 3.7 in 2000 with population growth.

Fire Protection.

City of Elko. The City of Elko has 15 full-time and 20 volunteer firefighters, including a new inspector (NENDA and SPR 1989). The fire department will be requesting an assistant fire marshall this year and three additional full-time firefighters in 1990 (Cash 1989). The department has mutual aid agreements with the Nevada Division of Forestry, the Bureau of Indian Affairs, and the BLM.

The method used to estimate increased demand for fire protection services is similar to that used for law enforcement. The number of firefighters is compared to the existing number of dwelling units to establish a service ratio. Six volunteer firefighters are considered equivalent to one full-time firefighter for insurance purposes; therefore, the City of Elko has the equivalent of 18 firefighters. This is equivalent to 4.6 firefighters for every 1000 units. Two fire protection personnel per 1000

dwelling units is a typical service standard (Leistritz and Murdock 1981) and is used in this analysis. By the end of 1989, the department is projected to have 21 equivalent firefighters for 5200 housing units for a service ratio of 4.0. In order to accomodate non-project-related growth at the typical service ratio, the City of Elko will need to obtain two additional firefighters by 1993, five by 2000, and ten by 2007.

City of Wells. The fire department in the City of Wells consists entirely of volunteers. The city has informal agreements with the Nevada Division of Forestry and the City of Elko (Dunn 1988).

As of 1989, the City of Wells had 15 volunteer firefighters to serve 500 housing units, or the equivalent of 5 firefighters for every 1000 residences. The City of Wells will need 0.4, 1.0, and 1.7 volunteer firefighters by 1993, 2000, and 2007, respectively.

Medical Care. Eight county ambulances serve Elko County, with two each in Elko, Wells, Jackpot, and Carlin. The service area in Elko County covers 500 square miles. Travel time from the project site and Wells to Elko General Hospital would be 90 minutes and 50 minutes, respectively.

A public health nurse serves Wells, Wendover, Jackpot, and Elko.

City of Elko. As of 1988, the Elko General Hospital has 16 physicians on staff and a 50-bed capacity. Other services provided by the hospital include an intensive care unit, obstetrics unit, full surgical and medical facilities, and ambulance service with 2-way communication with emergency room (1989). The Elko Medical Clinic has a staff of approximately 14 physicians with different specializations and a modern, fully equipped laboratory and x-ray facility (NENDA and SPR 1989). The physicians at the medical clinic are also employed at the hospital. Elko is experiencing difficulty attracting needed physicians and has formed a Physician Recruitment Committee to recruit a radiologist, a pediatrician, two family practitioners, an internist, a general surgeon, and an obstetrician. Other specialists, including an allergist and a cardiologist, also may be recruited (Hawkins 1989).

The existing 16 physicians in Elko serve a county population of more than 26,000 residents. The resulting service ratio of 0.6 physicians for 1000 residents is below a typical ratio of 1.0 physicians for 1000 residents (Leistritz and Murdock 1981). Elko will require additional physicians to accommodate non-project-related population growth, i.e., four doctors by 1993, nine by 2000, and 16 by 2007.

City of Wells. The Wells Medical Center consists of one doctor who is a general practitioner. The nearest hospital is Elko General Hospital, 50 miles away. The existing medical facility is ill-equipped, poorly designed, and too small, according to the physician (J. Smith 1989).

A public health nurse, serving Elko County, is also located in Wells. There is also one dentist office in Wells, Nevada.

Water Supply.

City of Elko. The existing water supply system has a flow capacity of 14 million gallons per day (mgpd). In addition, the City has planned looping in the distribution system and has sited another storage tank. The peak usage during the summer is 12 mgpd with an average usage during the summer months of 10 to 11 mgpd and a low usage during January of 3 mgpd (Klein 1989). Also, the City of Elko is planning to build two new water supply tanks with capacities of 2 million and 3 million gallons, increasing the total system storage capacity to 14.5 million gallons (Lipparelli 1988).

City of Wells. Water is supplied to the City of Wells by the Wells Municipal Water System. The water system is comprised of two pumps. The system has a water tank with a 1.3 million-gallon capacity. The peak water use is in July and August when usage can reach 2 mgpd (Schacht 1988). The existing water supply system can support 2300 to 2500 people. The water storage system can support 1400 to 1500 people (Marshall 1989).

The City of Wells has applied for a Farmer's Home Administration loan to conduct a complete upgrade of the water system. The planned improvements include the installation of additional and replacement water mains, valves, fire hydrants, and water meters; repair of the water tank; drilling of a new well; and construction of new pumping facilities (Yan 1989).

The city council has proposed to install water meters so that residents will be encouraged to conserve water, allowing the existing water system to serve more customers (Yan 1989). The city engineer feels that water usage will decrease because the water meters will discourage existing wasteful practices. It is estimated that the system will be able to serve 3400 to 3500 people after the installation of water meters. This will also increase the effective water storage capacity to serve 2000 to 2100 people (Marshall 1989).

The city estimates the rate for customers would increase from a flat rate of $18 to approximately $23 to $24 per month for water usage of 10,000 gallons or less to cover the new water bond and to create a capital improvements fund. After the water project is complete, the city ordinance will need to be rewritten to include new rates and changed so that new water and sewer hookups will be assessed capital fund charges (Yan 1989).

Wastewater.

City of Elko. The sewer service in the City of Elko is provided by the Elko Wastewater Treatment Facility located west of Elko. The existing capacity of the sewer treatment plant is 2.5 mgpd. The sewer system exceeded biochemical oxygen demand and total suspended solids levels for the use of the effluent to water the municipal golf course in 1988 (Lipparelli 1988).

In July 1988, the Elko City Council approved a contract with Chilton Engineering to prepare plans and specifications to improve the city's wastewater percolation ponds and to increase the capacity of the treatment facility. The construction of percolation ponds to increase the system capacity by 200,000 gallons was completed in the summer of 1989. The Chilton Engineering study recommended a three-phase approach to the modification and expansion of the sewer treatment facility. The phases are as follows:

- Phase I consists of an addition to the plant's capabilities, namely a biological tower to dispose of organic matter. The planned completion date for construction is March 1990. The design flow is 3.3 million gpd to serve a population of 21,000.

- Phase II includes the addition of pumps and a settling pond to increase the hydraulic capabilities of the facility and the addition of another sludge digester. This would increase the capacity of the existing plant to 3.9 mgpd to serve a population of 25,700. Construction is predicted to be completed in March 1991 but the schedule can be accelerated to accommodate unanticipated growth.

- Phase III consists of the development of a second treatment facility in proximity to the existing facility. This plant would be constructed in increments, up to a design capacity of 4.0 mgpd. The total wastewater capacity would then be 8.0 mgpd and could serve a population of 60,000 (Chilton Engineering 1988)

City of Wells. Wastewater services for the City of Wells are provided by the Wells Wastewater Treatment Facility. This facility was constructed in 1982 and consists of four ponds, two of which are holding ponds. Recent changes to the treatment system include the replacement of the old sewer lines from the plant to town with polyvinyl-chloride (PVC) pipe. In addition, the flow to the treatment facility has been decreased by rerouting flow from basements to the drainage system rather than through the treatment facility. The sewer permit with the State Health Department to dispose treated wastewater on 86 acres of irrigated farm land expired in August 1988. Another application has been filed, but a new permit has not been issued (Schacht 1988). The city usage is almost at the design capacity of 0.32 mgpd, with a current usage of 0.25 mgpd (Schacht 1989). This has decreased from a usage of approximately 0.30 mgpd before the sewer improvements. The city engineer believes that available capacity in the sewer system will increase with the introduction of water meters (Marshall 1989). Using a standard of sewer service of 150 gpd per person (Leistritz and Murdock 1981), the existing system could serve 2100 people. This standard is less than the current usage in Wells of 178 gpd per person, as should be expected with the high water usage in the city.

Solid Waste Disposal. Elko County controls a landfill for Spring Creek and other county areas near the City of Elko which has almost reached

capacity. There have been discussions to join the city and nearby county areas into a single landfill district. If the district is formed, the landfills would have available capacity for 3 to 5 years, depending on growth. It will take 3 to 5 years to site and develop another landfill (Klein 1989).

City of Elko. Disposal service in the City of Elko is provided by the Elko Sanitation Company. The city owns one landfill.

City of Wells. Solid waste disposal service in the City of Wells is provided by the City of Wells Sanitation Company. Solid waste is disposed at a landfill located in the northeast portion of the city. This landfill is nearing its capacity. The city has requested that the BLM grant lands located southeast of Wells for new landfill capacity.

Libraries.

The Elko County library system includes branches in Wells, West Wendover, and a station at Tucarora. The bookmobile travels extensively to small communities. The Elko County Library has children's programs available, such as reading, crafts, etc. (Madsen 1988).

City of Elko. The main branch of the Elko County Library is located in Elko and contains 80,000 volumes; the circulation for the county is 160,000 volumes per year.

City of Wells. The Wells Library is a branch of the Elko County Library System and is located in the same building as the City Hall. The Elko County Library is planning to build a new building for the Wells' branch library in 1990, if funding is approved. The library contains approximately 10,000 books and any book within the Elko County Library System can be requested and obtained. The branch library has a summer reading program for children up to the 3rd grade.

4.11.2.5 Public Finance

This section provides a discussion of tax rates that would be applied to construction and operation of TSPP. Nevada has a 6 percent maximum sales tax rate, which includes a 2 percent state sales and use tax, a 1.5 percent school support tax, a 2.25 percent County/City Relief Tax, and a 0.25 percent Mass Transit Tax, which is optional. Sales tax is assessed if an item is used in the county in which it is purchased. If an item is bought out of the county and/or state and is to be used in the county, the purchaser must pay a use tax that is equal to the foregone sales tax.

Property values are assessed by one of two agencies: the County Assessor's Office or the State Department of Taxation. Private properties that are contained within Elko County are valued by Elko County Assessor's Office. The assessed value is calculated as 35 percent of the value. The property tax to be applied to the assessed value is calculated every year. The 1988-89 tax rates for Elko County, City of Elko, and City of Wells were \$1.8535, \$2.3619, and \$2.2636, respectively (Elko County

Assessor's Office 1989). The tax rate is applied to each $100 of assessed valuation. For example, property taxes on a $100,000 property would be $1853.50, $2361.90, and $2263.60, respectively.

The Nevada Tax Commission establishes the value for assessment purposes of any property of an interstate and intercounty nature, which must include the property of all interstate or intercounty railroad, telegraph, water, telephone, air transport, and electric light and power companies, together with their franchises. The assessed value is distributed among counties or districts, usually based on a mile-unit valuation basis. The state legislature has the ability to approve forms of distribution of tax revenue. A common method of allocation is on the basis of population; counties with larger populations receive more of the assessed valuation. The legislature can also approve different distributions for phases of a project; for example, the construction and operation phases.

The Nevada Department of Taxation has developed cost-to-value conversion factors for each industry to estimate the value of a property during construction. The 1988-89 factor for electric companies is 0.9223 percent. The construction cost is reduced by this factor to determine the value. The assessed value is then calculated as 35 percent of that value (Earhart 1989).

The Wells City Charter establishes a lawful City government general obligation debt limit of 40 percent of the last assessed valuation of taxable property. The debt limit for 1989 was $4.7 million, with a $153,000 obligation debt subject to the limit. An additional $1.13 million of water revenue bond is proposed (George K. Baum & Company 1989).

4.11.2.6 Social Conditions

Information about indicator factors of social conditions was obtained from a variety of sources: local newspapers, articles, review of the socioeconomic impact analyst's records of discussions with community and county officials, input from Native Americans at a meeting of the Western Shoshone Elders, and review of concerns expressed at the EIS scoping meeting. A major source of information was interviews with community leaders and officials of the two communities studied. The interviews were conducted as open-ended telephone conversations, with a list of questions used as a guide during interviews. Interviews took place in April and May 1989. Individuals consulted in interviews are listed in the section on consultation.

City of Elko. Elko residents value the combination of urban amenities and a small-town setting that the city offers. Elko is currently responding to very rapid population increase associated with expansion of gold mining activities. Growth over the past 20 years had been under 5 percent annually until 1987 and 1988, when population increased by more than 30 percent, according to city staff. Because of the tax revenue cap, neither the city nor the county can fund significant staffing increases or changes in governmental structure in response to current increased demands for

services. They must wait until state estimates reflect the actual local population increase. However, city and county governments are working within those constraints to increase public services and to encourage increases in private services. Both city staff and private citizens express confidence that new demands will be met. They appear convinced that the response effort is adequate and appropriate. They characterize the current shortages and stresses as inevitable accompaniments of the rapid unplanned mining-induced growth.

Elko residents say that large-scale mining and associated construction jobs have attracted a more transient labor force than was present before the mining boom. The numbers of new residents have changed some of the qualities of daily life. Long-time residents say that traffic is worse, that drivers are rude, and that "driving under the influence" incidents are frequent. They say that the city used to be a quiet place, but now there are fights and incidents of break-ins and petty theft, and trespassing has become an issue because people don't respect property. They note that drugs have come into the schools, and parks are over-crowded. On the positive side, residents do not perceive an unemployment problem in the city, and they see that more specialty services and a greater diversity of supplies and equipment are available locally.

Residents, both old and new, perceive that some long-time families in Elko have been the "doers" in the city for many years. They note that many of the newcomers have little stake in the town because they will move on when the mining-related jobs are gone. More permanent residents guess that these people will have little effect on old patterns of social and political influence.

City staff say that old and new residents alike are in favor of continued growth in Elko. They feel that the city can handle it, that the "catch-up" with the mining boom is almost complete, and that the city still offers them qualities that have made it attractive all along, namely, a rural feel with many of the services that characterize a more urban community.

Recognized ethnic identities in Elko include American Indian, Hispanic, and Basque. The Elko Indian Colony has grown from about 240 residents in 1980 to about 900 in 1989. It is facing the same problems as the city as a whole - problems related to rapid population increase. Neither Indian nor non-Indian residents feel that Indians are identified as a distinct, separate group, except when their status as members of a separate nation is brought into play by the Federal government. The colony is physically surrounded by the city, and Indian children attend the same schools as non-Indian children do.

The Hispanic population, estimated to be approximately 10 percent of Elko's total, is recognized as the largest minority, but is thought to be relatively assimilated into the general population in terms of attitudes and characteristics. Basques are a very visible minority, although their

numerical representation in the population is unknown. Many are construction contractors or owners of other kinds of businesses. They are reported to be a strong collective group, very hard-working, and pro-growth.

City of Wells. Residents of Wells value the small size of the community, the individual privacy, and the geographic expanse of the area. Although the population of the City of Wells has grown by 15 percent or more since 1980, residents feel that change has come so slowly that it was hardly noticed.

Local employment is predominantly in the service industry; most people are waitresses, gas station attendants, bartenders, or dealers. These people would prefer other jobs if they were available. Local residents recognize that they must travel to other cities to obtain most of their goods and services. They see public services as generally adequate, but would like to see more diversity available in consumer goods and services.

Residents are in favor of population growth. They see it as the key to economic growth which, in turn, is necessary to support city services and to provide jobs for themselves and their children. They recognize that some problems come with growth; they point to increases in crime and strains on public services. However, they perceive that Elko is responding very successfully to rapid growth, and they believe that Wells could also be successful. This belief seems to come from the fact that Wells' public services and facilities are not yet used to capacity and are actively being evaluated to assure that they can handle additional growth.

The business community is concerned because the economy of the city is stagnant. Past and present city administrations have worked to attract new businesses directly and by providing infrastructure. They say that they cannot support city services without economic growth. There was a successful past effort to bring a state honor farm to the Wells vicinity, an unsuccessful bid for a major snowmobile event, and continued monitoring of mineral and oil finds in the area. Improvements to the airport have been carried out incrementally. An industrial park has been sited with sewer and water lines in place. A mobile home park is planned to go in next to the industrial park. The water and sewer systems have been upgraded, and Federal assistance is available to begin the final pre-construction phase: installation of water meters. The city expects that metering will cut water use in half and increase available sewer capacity. They report that they have already identified additional landfill capacity for solid waste.

The social organization and power structure in Wells has already undergone change. Only a few old-time families are left in the community. Newcomers are active in business and politics. Residents do not see a simple split between oldtimers and newcomers as the cause of acknowledged disagreements within the community. There are some disagreements rooted in disputes from years past, and some that simply

reflect different ideas about ways to reach similar goals. People are impatient with the divisiveness, but accept it as a given.

Recognized ethnic identities in Wells include American Indian and Hispanic. The Hispanic population, less than 10 percent, is seen as generally assimilated; they are characterized as indifferent to growth. The American Indian population, also less than 10 percent, is perceived as a more distinct entity. There is a residential colony and a tribal government. Depending upon who is in power in the tribal government, relationships between the city and the colony vary from cooperation to separation. According to the former mayor, in the past, residents of the colony have expressed an understanding of the need for economic growth in Wells.

4.11.2.7 Other Potentially Affected Communities

City of Twin Falls, Idaho. Twin Falls is located approximately 98 miles from the proposed power plant site via the proposed access road and approximately 140 miles via the Moor Summit Alternative access road. Twin Falls is the county seat for Twin Falls County, Idaho. It is also the largest community within 100 miles of the proposed power plant.

The city has an estimated population of 27,750 (1988). From 1960 to 1970, population in Twin Falls grew by 8.88 percent while the next decade saw an increase of 19.60 percent. Between 1980 and 1988, the estimated percent increase in population was 5.88 percent (Region IV Development Association 1989). Approximately 50 percent of the total population of Twin Falls County lived in the City of Twin Falls in 1988. While no projections of the city's population are available, the county population is expected to grow at an annual rate of 1.14 percent between 1987 and 1993 (Donnalley Demographics 1987). Applying the same growth rate to the city's population, it is estimated that the city's population will be 29,331 by 1993 and 31,546 by 2000.

The 1980 census gives the ethnic composition of the community. Ninety-four percent of the population is white, 4 percent is Hispanic, and the remaining 2 percent is accounted for by other racial groups. American Indians make up about 0.5 percent of the total city population (Region IV Development Association 1988). The average household size for the county in 1987 was estimated to be 2.7 and is projected to be 2.6 in 1992 (Donnalley Demographics 1987).

City-specific data on employment are not available (McDonald 1989). Twin Falls County as a whole has a civilian labor force of 23,743 (1989) with an unemployment rate of 5.2 percent. The number of persons employed has increased from 22,053 in 1978 to 24,511 in 1988. Currently, there are 1313 unemployed persons in the county (June 1989). Agriculture is the largest industry (McDonald 1989) with a fast growing dairy sector. In 1987, the per capita income for the county stood at $11,703 (Magic Valley Employment 1989). The latest figure available for the City of Twin Falls is a per capita income level of $9600 in 1985 (Region IV Development Association 1988).

There are approximately 10,000 housing units in the City of Twin Falls, based on electric hookup data (Region IV Development Association 1988). The housing stock has remained fairly steady over the last 3 to 4 years. Inquiries indicate that though property for sale is plentiful, the rental housing market is relatively tight (Zuck 1989; McAlindin 1989). In 1990, construction is anticipated to start in two approved subdivisions. Six more subdivisions have been plotted and are not yet filed for approval. There are over 1000 hotel and motel rooms in Twin Falls with occupancy levels around 80 percent in summers and 65 percent for the rest of the year (McAlindin 1988).

Twin Falls School District currently consists of six elementary, two junior high, and one senior high schools. The total enrollment for the 1988-89 school year is 6857, an increase of 87 students over the previous year. There are 321 teachers, 12 teacher aides, and 13 principals and assistant principals. The student-teacher ratio is 21:1 (Region IV Development Association 1988). The schools are presently near capacity and the school board is now doing preliminary work on estimating the future needs of the school district. Primary school funding sources are the State Board of Education and property tax revenues (McAlindin 1988).

Twin Falls (City) Police Department has 49 officers for a service ratio of 1.76 officers per 1000 residents. The city has 28 paid firefighters in the district with a service ratio of 2.72 firefighters for every 1000 households (based on the population and estimated household size). No expansion of facilities or personnel is planned in these areas at this time (McAlindin 1989).

Twin Falls contains two hospitals, two hospice facilities, and four nursing homes with a total of 139 physicians and 30 dentists. Magic Valley Regional Medical Center is the largest facility with 165 beds, intensive care units, and a proposed cancer unit to be added in 1989. While there are no plans to add staff at this time, personnel will be hired by the medical center as required. Twin Falls clinic and hospital, the second largest facility, has a total of 44 beds (McAlindin 1989). The 139 physicians serve the entire county population, with a service ratio of 2.43 per 1000 residents.

Idaho Power Company supplies electricity and natural gas is supplied by Intermountain Gas Company. Currently, no constraints are foreseen with respect to power and gas supply (McAlindin 1989). Water is provided by the city and comes from three reservoirs, three well sources, and a major groundwater source. The system capacity is 39 mgpd and the 1989 consumption level is 12 mgpd. The system was upgraded in 1987. The sewage system capacity currently is being expanded. The existing system handles 7.6 mgpd. Solid waste disposal involves about 150 tons per day on a 6-day basis. The landfill site has a life expectancy to the year 2000 (McAlindin 1989).

The State of Idaho has a basic sales tax rate of 5 percent and a corporate income tax rate of 8 percent. Property tax is collected at the rate of $2.0354 per $100 of assessed value. Property tax revenues are distributed among five jurisdictions in the following manner: county, 18 percent; city, 39.6 percent; school district, 28 percent; College of Southern Idaho, 8 percent; and Twin Falls highways, 6 percent. Idaho has a state personal income tax, which varies with the level of income (McAlindin 1989).

Jackpot, Nevada. Jackpot is a community of approximately 1546, located on Interstate 93 at the Nevada-Idaho border (Boucher 1989). It is approximately 55 miles from the proposed power plant site via the proposed access road and about 97 miles via the Moor Summit Alternative access road.

Using the average household size for the county (2.67 persons per household), it is estimated that there are about 579 households in the community at present. The economy is based on tourism and gaming (Boucher 1989). The town has recorded a growth of population of almost 95 percent since 1980 and is expected to continue to grow at the same rate. Applying an annual growth rate of 10 percent, almost 1700 persons will be added to the community by 2000.

Housing stock in the town consists of 27 single-family homes, 97 multifamily units, 180 mobile homes, and 12 apartment complexes with a total of 275 apartments. There are few homes available to rent, and the vacancy rates for apartments are reported to be low. There are about 93 RV spaces and 671 motel/hotel rooms. Motel/hotel vacancy rates tend to be low over weekends. Average vacancy rate is around 45 percent. Two hundred thirty-five motel rooms are planned, though no applications have been made for building permits (Boucher 1989).

There is one combined school at Jackpot which is under the jurisdiction of Elko County School District. The 1989 enrollment for the school was 262, having grown by 20 over the previous year. The school has a total capacity of 341 (Billings 1989).

Utilities are provided by the town. The water supply system has been updated with plans to add one more well. The sewage system can accommodate some population growth and also may be expanded in the future (Boucher 1989). The landfill for solid waste disposal has excess capacity. The town is unincorporated; therefore, law enforcement services are provided by the Elko County Sheriff's office. There are four officers and three vehicles in Jackpot. The fire department consists of one fire chief, two pumper trucks, and one emergency truck. Firefighters are volunteer workers (Boucher 1989).

There is no permanent medical facility in the town. A nurse from the public health department of the county visits the community twice a month. For medical emergencies, there are two county-operated ambulance units stationed in Jackpot. For all other medical help, the residents travel to Twin Falls (Boucher 1989).

Residents travel 48 miles to Twin Falls for most purchases (Boucher 1989).

Wendover/West Wendover, Utah, and Nevada. This pair of communities consists of West Wendover on the Nevada side and Wendover on the Utah side of the state border. They are located approximately 70 miles from the proposed power plant site via the Moor Summit alternate access road and 93 miles via the proposed access road.

West Wendover is an unincorporated community of Elko County with an estimated population of 2420 in 1989 (Boucher 1989). Over the period 1980-1989, the community grew by over 500 percent from a population of 395 in 1980. Much of this growth took place in the years 1983-1986, and since then the growth rate has leveled off (Boucher 1989). Based on an average household size of 2.67, there are an estimated 908 households in the community. West Wendover is currently facing an election which would allow incorporation by July 1990 (Boucher 1989).

Wendover (Utah) has an estimated population of 1500, which has grown from 1099 in 1980 at an average annual growth rate of 4.05 percent. Since the economic growth of Wendover is tied to the developments in West Wendover, it is assumed that population growth in Wendover also has leveled off (Wendover City Offices 1989).

The economy of both communities is based on tourism and gaming. West Wendover developed around truck-stop casinos which were established at this location in the mid-1980s. Wendover is mainly a bedroom community with most of its population working in West Wendover, and some people working locally in the service industry, i.e., in motels, restaurants, stores, and a chemical factory (Wheeler 1989).

Housing stock in West Wendover consists of 68 single-family homes, 364 mobile homes, 449 multi-family units, and 21 apartments. Additional housing is available in Wendover (Boucher 1989). There is a total of 444 apartment units available in both communities, of which approximately 16 to 18 percent are currently vacant (Crick 1989). There are no plans for construction of more housing. Transient housing consists of five hotels and one motel in West Wendover and six motels in Wendover with a total of 1064 rooms. West Wendover also has 139 RV spaces. Hotel rooms are almost entirely filled throughout the year but rooms are available in motels. Tourist volume increases on weekends and holidays (Boucher 1989).

There is one combined school in West Wendover which has an enrollment of 544. This enrollment has grown by 54 students since 1988-89 and the school is currently functioning at capacity (Billings 1989). Wendover has a high school with an enrollment of 280, 45 students more than the 1987-88 enrollment (Wendover High School 1989).

For medical care, the communities depend on Salt Lake City or Elko. The clinic at West Wendover is not open on a regular basis due to the lack

of a practitioner; however, the public health nurse in Wells visits Wendover periodically. For emergencies, a private ambulance company provides service with four ambulance units. There are four dentists in the communities (Boucher 1989).

Other community services consist of a volunteer fire department equipped with one engine that is shared by both communities; the Elko County Sheriff's office which provides law enforcement services through five personnel and four vehicles; and a city police department consisting of one chief, three officers, and two part-time personnel (Boucher 1989).

With respect to utilities, insufficient water supply is seen as a possible constraint on further growth in the two communities. For the past 3 years, Wendover has obtained water from the Nevada side when its own supply has been insufficient (Wheeler 1989). It is also reported that the West Wendover water supply system needs to be upgraded (Boucher 1989). While there is enough water at the source, the delivery system is proving to be insufficient. The sewage system in West Wendover is also reported to be approaching capacity and will be expanded with the addition of two evaporation ponds (Boucher 1989). On the Utah side, the sewage system has sufficient capacity, and expansion will be considered in 2 to 3 years (Wheeler 1989). Residents travel to Salt Lake City for most purchases (Boucher 1989).

4.12 LAND USE

4.12.1 STUDY AREA DEFINITION

The proposed project includes two major actions that could affect land uses: the proposed land exchange, and the construction and operation of the proposed power plant and associated facilities. These actions would affect land uses in the Toano Draw and Snake Mountain areas. The areas of affected environment for these two locations are described below.

4.12.2 BASELINE DESCRIPTION

The Toano Draw area currently consists of lands distributed in a "checkerboard pattern" of alternating private and Federal ownership. The checkerboard land pattern was created by the Railroad Grant Act of 1862 in which every other section of land, 20 miles on either side of the centerline of the Central Pacific Railroad, was granted to the railroad as incentive to construct. Currently, most of this land is privately owned and is no longer controlled by the railroad. The Federal lands are administered by the BLM. The Federal lands fall within the Wells Resource Area of the Elko District BLM.

Lands in the Toano Draw occur within a relatively flat, expansive valley at an elevation of about 5600 feet. These lands are currently undeveloped and are primarily used for livestock grazing. To allow for land tenure adjustments, the Wells Resource Management Plan (BLM 1984)

divided lands into three categories or management classifications: Disposal (D), Retention/Management (R/M), and Retention/Consolidation (R/C). Lands within each category were delineated on the basis that disposal areas are difficult to manage and have essentially no resource values, and resource values are fewer, and consequently, less cost effective to manage in R/M areas as compared to R/C areas.

Lands can be disposed of by any available means; however, the primary means is through public sale. Lands within these areas typically meet the Federal Land Policy and Management Act sale criteria.

The R/M areas are, as the name implies, to remain under BLM management. They are, however, suited for exchange for private lands within the R/C areas and development under the agriculture land laws. Exchanges that would acquire R/M lands are discouraged.

R/C lands are high resource value public lands that are to be retained and managed intensively and consolidated where possible to enhance management opportunities. Disposals of any nature will generally not occur in the R/C areas.

The Wells Resource Management Plan identifies the lands within Toano Draw as being within a R/M area, and are not within any BLM-designated wilderness or recreation areas, nor are they within any environmentally critical habitat areas (e.g., wild horse herds, streamside riparian habitiat, big game habitat, etc.).

The offered lands within the Snake Mountains proposed for exchange exist within mountain elevations between 6500 to 8200 feet above sea level. The lands are undeveloped, and are used for hunting, hiking, fishing, road vehicle access, and mineral exploration. Land ownership within the general area consists of semi-consolidated and "checkerboard pattern" Federal and private lands.

The offered lands are adjacent to designated R/C areas to the north and south. The offered lands meet the criteria that was developed for R/C areas but due to the solid block nature of the private property no consideration was given to its acquisition during the planning process. Since it does adjoin the R/C area, it would be a logical extension of the land use designation to include it. According to the Wells Resource Management Plan (BLM 1984), the lands are not within any designated planning corridor, area of critical environmental concern, or designated environmentally sensitive habitat areas.

It is the BLM's responsibility to maintain and/or improve range conditions on the public lands in Nevada. Forage allocations, based upon the results of intensive, on-the-ground inventories, are made through the BLM's planning system. Key elements of range management include authorizing and supervising grazing use and developing and maintaining supportive management facilities.

Livestock grazing is one of the major land uses within the project study area. Grazing allotments which would be affected by the proposed action and/or alternatives are shown on Figure 4.12-1.

The grazing allotments and permittees whose grazing preference would be potentially affected by the proposed action and/or alternatives are listed below:

Allotment Name	Grazing Permittee	Active Grazing Preference (AUMs)
Gamble Individual	Lands of Sierra, Inc.	17,938
HD	Lands of Sierra, Inc.	22,827
Hubbard Vineyard	Boies Ranches, Inc.	13,096
Stormy	Mary's River Ranch	6,294
Black Butte	William Max Spratling	6,461
Big Springs	Demar Dahl	18,272

The allotment most affected by both the construction activities and the land exchange is the HD Allotment. Lands of Sierra runs approximately 3000 cattle on a year-around basis on this allotment. The allotment is presently being grazed in accordance with the Dairy Valley, Gamble-Individual and HD Allotment Management Plan approved September 20, 1989.

In addition, the land exchange would affect the grazing preferences in the neighboring Black Butte, Hubbard Vineyard, and Big Springs Allotments.

The selected lands to be exchanged in the Toano Draw area are primarily used for grazing. A total of 15,962 acres of selected lands, which support an estimated combined total of 1244 Animal Unit Months (AUMs), are being considered for the exchange. An AUM is a measure of the amount of forage necessary for the sustenance of one cow or its equivalent for 1 month and is typically used to quantitatively rate the potential yield of land used for grazing.

The offered lands total 13,414 acres. These lands have a total combined rating of 2753 AUMs.

In addition to grazing, other land uses in the vicinity of the proposed project site include light and dispersed recreation (see Section 4.10.3) and access to various surrounding areas.

4.13 TRANSPORTATION

4.13.1 STUDY AREA DEFINITION

The regional transportation network serving northeastern Nevada includes an established system of interstate, state, and regional highways and roads, and rail lines. U.S. Highway 93 serves as a north-south

transportation route and is located about 13 miles west of the proposed project site. Interstate 80 (I-80) serves as the region's major east-west transportation route and is about 17 miles south of the project site. Several other state highways and rural routes also provide access in the regional area between the local towns and communities, and outlying areas. The Southern Pacific and Union Pacific railroads have rail lines to the south and west, respectively, of the project site. These rail lines link the major communities of the regional area and provide access to intercontinental routes.

4.13.2 BASELINE DESCRIPTION

4.13.2.1 Interstate 80

I-80 is a major transportation route for the regional project area, as well as for northern Nevada. I-80 extends from California, and crosses Nevada through Reno, Lovelock, Winnemucca, Elko and, near the project site, the communities of Wells and Oasis. This freeway serves intrastate traffic, as well as interstate passenger and freight traffic. I-80 is a four-lane divided freeway throughout Nevada, except near Reno, where it is six lanes. Traffic volumes, based on spot counts for 1987, range from as high as 12,000 to 14,000 vehicles per day near the Reno area to 4000 to 5000 vehicles per day near the Utah border (NDOT 1987).

4.13.2.2 U.S. Highway 93

Highway 93 is a two-lane undivided highway that extends from Pioche in Lincoln County, Nevada to Idaho. This highway is a primary north-south transportation route for eastern and northeastern Nevada, connecting Pioche, Ely, Wells, Jackpot, and Southern Idaho, including Twin Falls. It crosses I-80 at an interstate interchange just east of Wells. Traffic volumes on this route in the regional area of the project site in 1987 ranged from approximately 500 vehicles (south of Wells) to over 2000 vehicles (at Jackpot near the Nevada-Idaho border) per day. Trucks account for about 30 percent of the total vehicle volumes (NDOT 1987).

Highway 93 is a conventional highway, with a 32-foot-wide roadbed, that accommodates two 12-foot-wide paved travel lanes and dirt shoulders. It has an asphalt-pavement surface and has been structurally designed to carry approximately 2200 vehicles daily, of which 500 (or 23 percent) are heavy trucks. Highway 93 from Wells to Wilkins is planned for reconstruction, involving replacement of the existing pavement and subgrade materials (Cress 1989).

4.13.2.3 Safety and Road Closures

Snowstorms which have closed roads have occurred in the past in the project area. NDOT reports that Highway 93 was closed three times over the HD Summit (south of Wilkins) in 1988-1989 due to snowdrifts (Pray 1989). It can be expected that this road may be closed two to three times each year for a half day or more. I-80, although subject to the same inclement weather, is not normally closed since it is given a high priority for snow

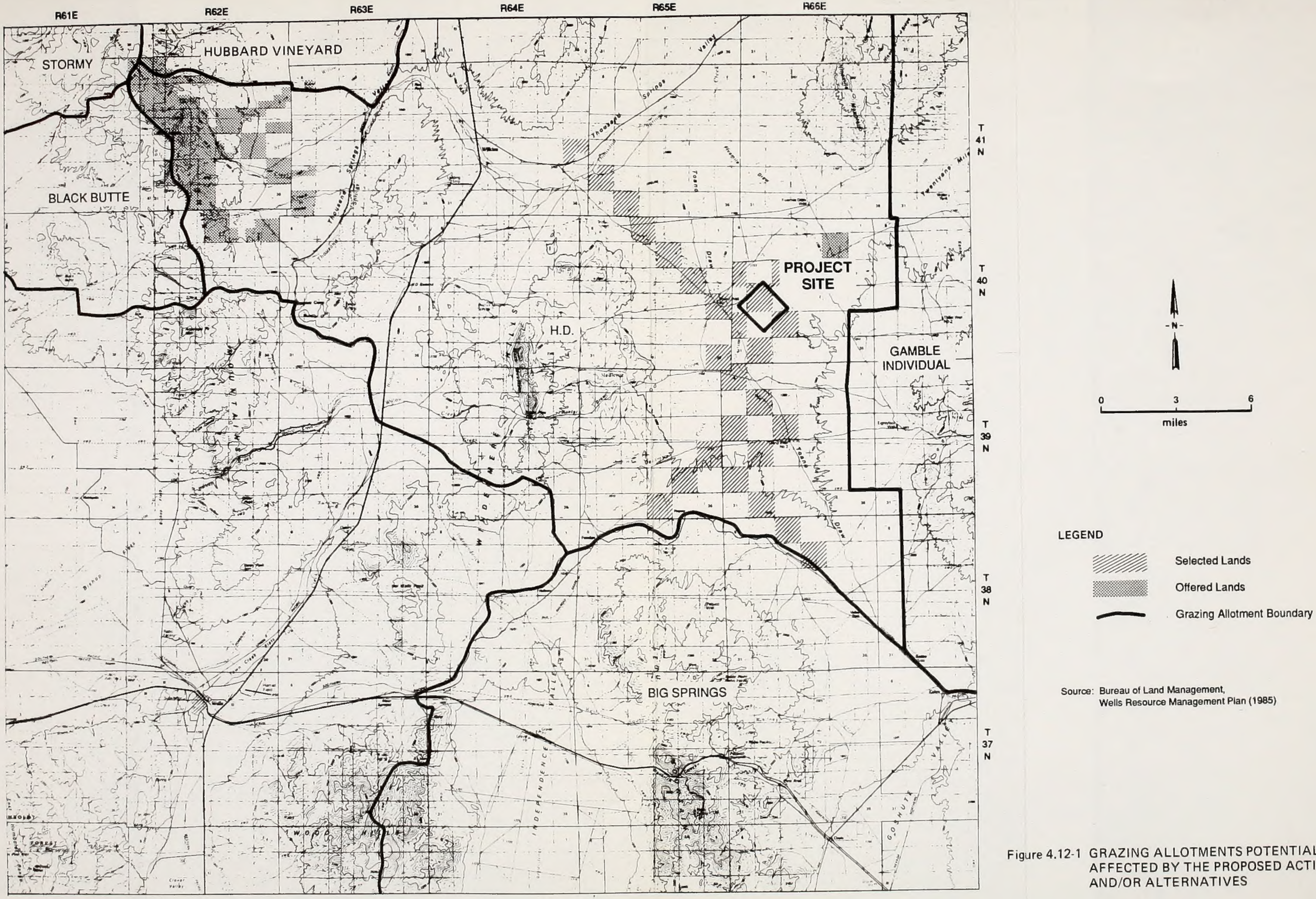


Figure 4.12-1 GRAZING ALLOTMENTS POTENTIALLY AFFECTED BY THE PROPOSED ACTION AND/OR ALTERNATIVES

removal and has the advantage that traffic can be diverted to other travel lanes until the problem is corrected (Cress 1989).

4.13.2.4 Railroad Lines

Nevada railroads provide an important means of intra- and interstate shipment of commerce, freight, and passengers, and served a key role in the development of northeastern Nevada. The Southern Pacific Railroad (SPRR), which runs in an east-west direction across Nevada between northeastern Nevada and the California border west of Reno, was the original Central Pacific transcontinental rail line constructed in the 1800s. This rail line helped in the settlement of a number of communities in Nevada, including Wells. The SPRR crosses the Nevada-Utah border just south of Route 233 near Tecoma. The railroad roughly parallels Route 233 heading southwest until Cobre in Goshute Valley, where it turns northwest and extends around the northern edge of the Pequop Mountains. At this point, the SPRR is within approximately 10 miles of the project site. The railroad then heads southwest towards I-80 and Wells and continues west through Reno and into California. Currently, approximately 18 trains per day use the SPRR through this region, including trains for SPRR, Union Pacific, and Amtrack (Jay 1989).

Other railroads in northeastern Nevada include the Western Pacific completed in the early 1900s, which generally parallels the SPRR. The two railroads cross and split at Wells, with the Western Pacific heading southeast between Wells and the Utah border, crossing the Central Pequop Mountains through tunnels, and joining the I-80 freeway near Utah.

Two north-south railroads also exist in the project region. The Northern Nevada Railroad was constructed to serve mining operations in Ely in White Pine County; this railroad extends from Ely to Cobre, where it connects with the SPRR. The Union Pacific railroad, originally the Idaho Central, was built to serve mining, farmers, and ranchers from Wells north through Twin Falls, Idaho. This railroad paralleled Highway 93 and has been abandoned.

removal and has the advantage that traffic can be diverted to other travel lanes until the vehicle is corrected (Cross 1990).

4.13.2.4 Railroad Lines

Nevada railroads provide an important means of intra- and interstate shipment of commerce, freight, and passengers, and served a key role in the development of northeastern Nevada. The Southern Pacific Railroad (SPRR), which runs in an east-west direction across Nevada between northeastern Nevada and the California border west of Reno, was the original Central Pacific transcontinental rail line constructed in the 1860s. This rail line helped in the settlement of a number of communities in Nevada, including Wells. The SPRR crosses the Nevada-Utah border just south of Route 233 near [illegible]. The railroad roughly parallels Route 233 heading southwest until [illegible] in [illegible] Valley, where it turns northwest and extends around the northern edge of the Pequop Mountains. At this point, the SPRR is within approximately 10 miles of the project area. The railroad line heads southwest towards I-80 and Wells and continues west through Reno and into California. Currently, approximately [illegible] trains per day use the SPRR through this region, including freight, Union Pacific, and Amtrak (Cox 1990).

Other railroads in northeastern Nevada include the Western Pacific (WPRR), completed in the early 1900s, which generally parallels the SPRR. The railroads cross and split at Wells, with the Western Pacific heading southeast between Wells and the Utah border, crossing the [illegible] Mountains and joining the I-80 towards [illegible].

The [illegible] Northern Railway also exists in the region. The Nevada Northern Railway was constructed in [illegible] to [illegible] in Wells. The [illegible] railroad extends from [illegible] to connect with the SPRR. The Union Pacific [illegible] Kennecott, [illegible] copper mining, formerly [illegible] through [illegible], Nevada. This railroad operated [illegible] been abandoned.

5.0 ENVIRONMENTAL CONSEQUENCES

The purpose of this section is to describe potential environmental impacts for each of the three components (land acquisition, construction, and operation) of the proposed action and alternatives. Specifically, this section describes the assumptions and assessment guidelines used in analyzing the environmental consequences, and the potential direct and indirect impacts of the proposed action and alternatives on the environment. Potential impacts to resources were analyzed only for those alternatives which could be expected to have an effect on that resource.

Mitigation measures have been recommended in this Environmental Impact Statement (EIS) which could avoid or reduce the anticipated impacts of the proposed action and alternatives. Residual impacts or unavoidable adverse impacts are identified which remain after mitigation measures have been applied. It should be noted that recommended mitigation measures presented in the Draft Environmental Impact Statement (DEIS) have not been adopted for the proposed project. After the public review period is complete, the Bureau of Land Management (BLM) will identify final mitigation measures in consultation with other agencies and the applicant and include these in the Final Environmental Impact Statement (FEIS).

This section also describes any possible conflicts between the proposed action and Federal, state, and local land use plans and policies; cumulative impacts; unavoidable adverse impacts; short-term use versus long-term productivity; and irreversible and irretrievable commitment of resources.

5.1 AIR QUALITY

5.1.1 PROPOSED ACTION

Air quality analyses were conducted to evaluate potential environmental impacts from the construction and operation of the proposed Thousand Springs Power Plant (TSPP). Air quality issues of concern are briefly described below and discussed in more detail in subsequent sections.

During construction phases, concern for air quality involves emissions from combustion engines and fugitive dust generated during construction-related activities. Fugitive dust emissions could also occur by wind erosion of exposed soil surfaces and machinery/vehicle activity.

Potential impacts as a consequence of plant operation include increased ambient air concentrations from gaseous and particulate emissions from boiler stacks due to coal combustion; effects on visibility from boiler stack emissions; particulate emissions from cooling tower drift (dissolved chemicals in the drift water droplets that solidify upon evaporation); and fugitive particulate matter emissions from storage, handling, and conveyance operations involving coal, ash, and lime.

In addition to the above, during plant operation, sulfur dioxide (SO_2) and nitrogen oxides (NO_x) emissions could affect air quality related values (AQRVs) in Class I areas in the region. Air quality related values that could be affected include visibility, water, flora, and fauna. Associated with potential impacts on AQRVs are the effects from acid deposition. Possible impacts from acid deposition in regional Class I areas, other wilderness areas, and wilderness study areas are also addressed.

Recently, there has been increased concern over potential effects from emissions of carbon dioxide into the atmosphere due to the combustion of fossil fuels on global climate change. Global warming and increased emissions of carbon dioxide from the TSPP are discussed.

5.1.1.1 Construction

Air pollutant emissions from site construction activities would primarily be from:

- Fugitive particulate emissions from land clearing, site preparation, and from vehicles and construction equipment traveling over unpaved areas
- Fugitive particulate emissions from wind erosion of exposed areas
- Engine exhaust emissions from operating heavy-duty diesel-powered and gasoline-powered construction equipment and vehicles

In addition, road paving work and painting would result in the release of some hydrocarbons. These emissions are not considered further in this analysis since they would be small, temporary, and insignificant.

Table 5.1-1 provides information on the total acreage of land disturbed during different project construction phases over the 20-year period, broken down by month and year, based on the proposed construction schedule. These acreages represent estimates of the actual areas that would be expected to be disturbed. It is expected that during construction land disturbance activities would occur, at most, 5 days per week, 10 hours per day. The approximate number of acres worked per day for each of the different construction activities during construction of the first 250-MW generating unit are listed in Table 5.1-2. These construction activities do not necessarily occur concurrently or in the same location. Therefore, emissions from these activities would not all be concentrated in one area.

Table 5.1-1. APPROXIMATE MONTHLY AND ANNUAL ACREAGE OF LAND DISTURBED DURING CONSTRUCTION ACTIVITIES

Unit	Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Monthly Maximum	Annual Total
1	1991	6.0	6.0	11.0	62.0	71.0	79.0	82.0	50.0	29.0	3.5	1.0	0.5	82.0	401
	1992	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	21.5	9
2	1993	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	1994	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
3	1995	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	1996	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
4	1997	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	1998	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
5	1999	0.0	0.0	0.0	4.0	4.5	13.5	16.5	20.5	18.0	8.5	1.0	0.5	20.5	87
	2000	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
6	2001	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	2002	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
7	2003	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	2004	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9
8	2005	0.0	0.0	0.0	4.0	4.5	10.5	13.5	11.5	10.0	3.5	1.0	0.5	13.5	59
	2006	0.5	2.5	2.5	2.5	0.5	0.5	0.0	0.0	0.0	0.0	0.0	0.0	2.5	9

Table 5.1-2. APPROXIMATE NUMBER OF ACRES WORKED PER DAY FOR DIFFERENT ACTIVITIES DURING CONSTRUCTION OF THE FIRST UNIT

Area	Area Worked (Acres/day)
Access Road	1.4
Railroad Spur	0.5
Main Plant & Rel. Area	0.6
Railroad Loop	1.1
Construction Worker Camp	0.6
Switchyard	0.4
Roads (on-site)	0.2
Cooling Towers	0.4
Major Drainage Structure	0.1
Solid Waste Disposal	0.3
Sewage Lagoon	0.1
Evaporation Ponds	0.5
Laydown	0.3
Coal Run-off Pond	0.2
Coal Piles	0.4

During the initial construction activities, the majority of the land would be disturbed in order to grade the site to its final elevation and provide access roads to the facility. After initial land disturbance takes place and Unit 1 begins operation, construction-related land disturbance activities will be substantially reduced until construction begins for the fifth generating unit. When construction of Unit 5 occurs, the degree of land disturbance activities would increase, but to levels less than those required for Unit 1. After Unit 5 is completed, construction-related land disturbance activities for the remaining generating units would again decrease to about the same levels as would occur for Units 2 through 4. Therefore, maximum construction generated air emissions and maximum plant generated emissions would not occur simultaneously.

A variety of different types of construction equipment would be required for site preparation, access road and railroad spur construction, and land clearing during the initial construction phase. Equipment used would include the following:

Site Area and Main Access Road:

- 10 scrapers
- 4 push cats
- 5 bulldozers
- 3 compactors
- 2 water trucks
- 3 loaders

Outlying Area Railroad:

- 4 scrapers
- 2 push cats
- 2 bulldozers
- 2 compactors
- 1 water truck
- 1 loader

Additional maintenance equipment would be required to support the on-site construction activities (e.g., delivery trucks, haul trucks, and fuel-lube trucks). The primary airborne pollutants from construction activities would be particulates released during land clearing and site preparation activities.

When conditions are favorable for dust generation, dust control would be provided through appropriate measures to reduce off-site impacts as well as improve on-site working conditions. Methods to control dust include minimizing the area which is subject to disturbance at any one time, use of mulch or other temporary covers on exposed soil areas, and limiting the movement over exposed soil surfaces. During dry weather conditions, spraying water on areas subject to heavy construction vehicle traffic will help to control dust. Paved areas should also be kept clear of loose dirt that can be re-entrained into the air during vehicle passage.

Estimates of particulate emissions from land disturbance activities during construction of Units 1 through 8 are provided in Table 5.1-3. These emission estimates are provided on a monthly basis for each year that construction activity is scheduled. The maximum monthly particulate emissions were estimated to be 240.6 tons, which would occur during the first year of construction. It has been estimated that the largest area disturbed in a single day would be approximately 1.4 acres during access road construction. This disturbance would occur at most only 10 hours during the 24-hour period.

Fugitive particulate emissions from land disturbance activities would primarily be ground-level ambient releases and of short-term duration at any given location. Impacts would therefore be temporary, transient, and localized in nature, and would not have a significant impact on long-term local or regional air quality. Additionally, fugitive dust emissions from unpaved roads and other areas would be controlled by water, or other approved methods.

Exhaust emissions associated with construction equipment operation are composed of the primary fuel combustion byproducts: nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), hydrocarbons (HC), and a small percentage of sulfur oxide (SO_x) compounds. Emission rates from construction equipment would depend on the level of construction activity and types of equipment used. With the level of equipment operation on site spread out over a large area, exhaust emissions would not be concentrated in any given area and should not result in violations of any state or Federal ambient air quality standards. Therefore, these emissions would be insignificant.

5.1.1.2 Operation

Pollutant Emissions from the Proposed Project. The major source of pollutant emissions during the operation of the proposed TSPP would result from the combustion of pulverized coal in the eight steam generators. Other emission sources include the coal-, ash-, and lime-handling facilities, cooling towers, and a fuel oil storage tank. Each of these sources are discussed in the following sections. A summary of estimated emissions from the entire proposed plant (all emission sources) is presented in Table 5.1-4. Additional discussion of the air quality analysis conducted for this project can be found in the Air Quality Technical Report for this project. The following summarizes the findings of the analysis.

Power Plant Emissions. Air pollutant emissions associated with operation of the power plant would result primarily from pulverized coal combustion. Each of the eight 250-megawatt (MW) units would be served by a separate stack.

Estimated air emissions of SO_2, NO_x, PM_{10}, and CO from the power plant stacks are given in Table 5.1-5. The table provides cumulative emissions

Table 5.1-3. ESTIMATED PARTICULATE EMISSIONS FROM CONSTRUCTION ACTIVITIES (TONS)

Unit	Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Monthly Maximum	Annual Total
1	1991	3.6	3.6	6.6	37.2	42.6	47.4	49.2	30.0	17.4	2.1	0.6	0.3	49.2	240.6
	1992	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
2	1993	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	1994	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
3	1995	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	1996	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
4	1997	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	1998	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
5	1999	0	0	0	2.4	2.7	8.1	9.9	12.3	10.8	5.1	0.6	0.3	12.3	52.2
	2000	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
6	2001	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	2002	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
7	2003	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	2004	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4
8	2005	0	0	0	2.4	2.7	6.3	8.1	6.9	6	2.1	0.6	0.3	8.1	35.4
	1994	0.3	1.5	1.5	1.5	0.3	0.3	0	0.0	0	0	0	0	1.5	5.4

Note: Emissions are based on 1.2 tons/acre/month (EPA 1985a) for each acre disturbed, assuming 50 percent dust control using watering.

Table 5.1-4. ESTIMATED CONTROLLED AIR EMISSIONS FROM THOUSAND SPRINGS POWER PLANT PROJECT

Source	Short-Term Maximum (lbs/hr)	Annual[a] (tons/yr)
Power Plant[b]		
Sulfur Dioxide	3,696	13,762
Oxides of Nitrogen[c]	9,241	34,405
Particulate Matter	314	1,171
Carbon Monoxide	2,384	8,876
Volatile Organic Compounds (VOCs)		
Methane	35.2	130
Nonmethane	82.4	305
Cooling Towers		
Particulate Matter	64.0	238.2
Chloroform	1.3	5.0
Coal-, Lime-, and Solid Waste-Handling		
Particulate Matter	37.1	64.5
Fuel Oil Storage		
Nonmethane VOCs	0.2	0.7

[a] Annual emissions based on an 85 percent load factor.

[b] Emissions of oxides of nitrogen, sulfur, and particulate matter from the power plant are based on current proposed control technologies of 0.45 lbs/MMBtu, 0.18 lbs/MMBtu, and 0.005 grains per actual cubic foot, respectively. Maximum heat input required for guaranteed turbine conditions at full load (2567 MMBtu/hr).

[c] As nitrogen dioxide.

Table 5.1-5. ESTIMATED CONTROLLED EMISSIONS FROM PROPOSED TSPP STACKS

	Number of 250-MW Units (Year Operational)							
	1 (1994)	2 (1996)	3 (1998)	4 (2000)	5 (2002)	6 (2004)	7 (2006)	8 (2008)
Maximum Short-Term (lb/hr)								
SO_2	462	924	1,386	1,848	2,310	2,772	3,234	3,696
NO_x	1,155	2,310	3,465	4,621	5,776	6,931	8,086	9,241
PM	39	79	118	157	197	236	275	314
CO	298	596	894	1,192	1,490	1,788	2,086	2,384
Annual Average[a] (tons/yr)								
SO_2	1,720	3,440	5,161	6,881	8,601	10,321	12,042	13,762
NO_x	4,301	8,601	12,902	17,202	21,503	25,804	30,104	34,405
PM	146	293	439	585	732	878	1,024	1,171
CO	1,109	2,219	3,328	4,438	5,547	6,657	7,766	8,876

[a] 85% Capacity factor applied for all years.

Note: (1) Expected plant capacity factors for each unit:

85% for years 1 through 10

80% for years 11 through 20

75% for years 21 through 35

(2) Emissions based on fuel heat input required for maximum guaranteed turbine conditions at full load (2567 MMBtu/hr)

as each 250-MW unit becomes operational. Maximum short-term emissions for each unit were calculated based on the applicant's proposed Best Available Control Technology (BACT) emission limits for the first unit (see discussion below), a heat input to the boiler of 2567 million Btus per hour (MMBtu/hr) corresponding to turbine maximum guaranteed steam flow, and assuming 100 percent load with all equipment operating normally. Long-term emissions estimates were calculated assuming an average capacity factor of 85 percent over the plant life with all equipment operating normally. That is, the capacity factor reflects the fact that each 250-MW unit would not be operated 100 percent of the time due to downtime for inspection and maintenance, and that they would not be operating at full load 100 percent of the year. For each unit, the capacity factor is expected to decrease with age, with 85 percent expected for the first 10 years, decreasing to 75 percent for years 21 through 35.

As an estimate of future emissions, the emission limits for Unit 1 based on the applicant's proposed BACT were applied to all units. Realistically, overall plant emissions at full buildout should be lower since this project is a phased construction project and the PSD permit associated with this type of project requires that BACT be evaluated for each unit prior to its construction. This means that as applicable control technology with increased efficiency becomes commercially available it could be required for future units.

Coal for the TSPP is proposed to be supplied to the site from mines at Kemmerer, Wyoming (Kemmerer coal) and Scofield, Utah (Skyline coal). Coal from each mine would be blended for use in the boilers. This blended coal is considered the design basis or "Performance" coal, and would be the basis for equipment specifications and manufacturer guarantees. Each mine would supply coal in an amount approximately equal to 50 percent on a heating value basis. Coal would be delivered by rail. Table 3.1-5 provides analyses of the Kemmerer and Skyline coals, while Table 5.1-6 shows the typical characteristics of the Performance coal.

Because the emission limitations currently proposed as BACT for SO_2 are in terms of pounds of SO_2 per million Btu (lb/MMBtu) of heat input, the emissions are expected to vary only with changes in plant electrical load (i.e., fuel combustion rate). It would not vary with fuel type, as would emissions with a specified SO_2 removal efficiency. In order to achieve the specified lb/MMBtu emission limit, the control equipment would have to operate at different efficiencies due to the variation of the sulfur content in the different coals. Approximate SO_2 control efficiencies based on the expected range of sulfur content for the Kemmerer, Skyline, and Performance coals are shown in Table 5.1-7. Control efficiencies range from a minimum of about 77 percent for the minimum sulfur content of the Skyline coal to a maximum of 91 percent for the maximum sulfur content of the Kemmerer coal. On the average, using the Performance coal, a control efficiency of 87 percent would be achieved. Table 5.1-7 illustrates that by setting the emission limit in terms of pounds per million Btu rather than in terms of a percent removal, there is flexibility to use coal types

Table 5.1-6. TYPICAL PERFORMANCE COAL CHARACTERISTICS

Ultimate Analysis (As Fired)	Performance Coal
Percent Carbon	59.86
Percent Hydrogen	4.23
Percent Nitrogen	1.09
Percent Chlorine	0.02
Percent Sulfur	0.73
Percent Oxygen	11.05
Moisture	15.94
HHV Btu/lb	10,580

Table 5.1-7. APPROXIMATE SO_2 CONTROL EFFICIENCIES FOR DIFFERENT COAL TYPES

	Kemmerer Coal			Skyline Coal			Performance Coal
	Average	Min.	Max.	Average	Min.	Max.	Average
Btu/lb	9,800	--	--	11,500	--	--	10,580
Percent Sulfur	0.80	0.60	1.00	0.65	0.45	0.80	0.73
Uncontrolled Emissions (lb/hr)	4,191	3,143	5,239	2,902	2,009	3,571	3,542
Percent Sulfur Dioxide Removal	89	85	91	84	77	87	87

Notes: Uncontrolled emissions based on average heating value and coal sulfur content.

Controlled emissions based on 0.18 lb SO_2/MMBtu and a maximum heat input rating at full load of 2567 MMBtu/hr.

of varying sulfur content. Whereas, if BACT were specified as a minimum percent SO_2 removal, there would be less incentive to use low sulfur coals since, for example, it is easier to remove 90 percent of the SO_2 from a higher sulfur coal than a lower one.

Coal-, Ash-, and Lime-Handling Emissions. Coal-handling operations within the power plant area would be conducted primarily using covered conveyor systems. Ash- and lime-handling operations would be conducted primarily using hydraulic and pneumatic conveyors.

Airborne particulate matter would be generated during each of the handling operations involving coal, lime, and solid waste (i.e., fly ash and bottom ash). However, a high level of dust control would be provided in the design of the proposed TSPP by venting emissions through a baghouse for those sources that could be contained or through the use of water spray on storage piles or open sources.

In order to evaluate the air quality impact from these emissions at full operation of TSPP, emissions from each of the individual activities were computed. Estimated controlled emissions from the coal-, ash-, and lime-handling operations are provided in Table 5.1-8. Emission rates were estimated based on methods outlined in the Environmental Protection Agency Compilation of Air Pollutant Emission Factors, AP-42 (EPA 1985a, 1988b) or using engineering methods based on the design control efficiencies of the air pollution control equipment and material throughout. Short-term particulate emission rates (24 hours or less) were computed based on full operation of the proposed TSPP at capacity with all eight units on-line. Long-term (annual) particulate matter emission rates were based on an annual usage factor of 85 percent capacity per unit for the individual boiler coal silos and associated transfer stations and ash handling activities. However, the majority of the coal and lime handling activities would be operated at, or near, capacity during the arrival of new shipments and material transfer. During the remainder of the time, maximum emissions would not be generated. Annual emissions from the lime transfer operations and from coal handling during railcar unloading and initial conveying and transfer to the active storage (coal storage silos or storage pile) locations were adjusted based on an annual usage factor of 60 percent capacity.

Emissions from the rail car unloading operations and collecting transfer conveyors, which would not be vented through a baghouse, were computed using AP-42 emission factors (EPA 1988b). Water sprays would be used to control fugitive dust emissions from sources not vented and were assumed to provide a 50 percent reduction in fugitive emissions. Emissions from the transfer silos, crushers, and storage silos which would be vented through a baghouse were computed using engineering calculations. Emissions were based on a maximum design control emission rate of 0.01 grains per dry standard cubic foot of air vented through the baghouse when the unit is operating at full capacity. Long-term emission rates were adjusted based on a capacity factor of 85 or 60 percent based on the primary use of the equipment.

Table 5.1-8. ESTIMATED EMISSIONS FROM COAL-, ASH-, AND LIME-HANDLING

Source Type	Particulate Emissions: Short-Term Maximum (lbs/hr)	Particulate Emissions: Long-Term (tons/yr)
Coal Silos, Transfer Towers, Crushers	20.20	48.67
Coal Storage Piles[a]	12.82	8.19
Coal Unloading and Conveying	0.67	1.77
Ash and Solid Waste Handling[a]	2.33	5.88
Lime Storage Silos	1.10	0.01

[a] Assumes a 20 m/sec windspeed for peak hour wind (based on conditions of maximum modeled concentration) and a 4.9 m/sec windspeed (annual windspeed) for annual emissions.

Additional details on emission calculation methods and assumptions are provided in the Air Quality Technical Report.

Cooling Towers. Cooling tower emissions consist primarily of water; however, progressive evaporation losses from the circulating water would concentrate dissolved solids up to 20 to 30 times their concentrations in the makeup water. The dissolved materials would be released as a mist from the cooling tower that would evaporate in the atmosphere and later be deposited as particulate matter when the material settled out of the cooling tower plume. Thus, the cooling tower was included in the evaluation of airborne particulate matter from the proposed TSPP. Estimated particulate matter emissions for the cooling towers at full buildout are presented in Table 5.1-4.

In addition, the cooling tower water would be treated with chlorine to prevent biological growth and slime buildup. The amount of chlorine added per cooling tower would be approximately 200 pounds per day. Disinfection would primarily occur from the formation of hypochlorite ions in the cooling tower water. These ions are nonvolatile, however, halogenated organic compounds could be formed in the cooling tower water, many of which are volatile, and thus, could be emitted to the atmosphere. According to a recent study by the Electric Power Research Institute (EPRI 1986), the only halogenated organics observed to be formed in chlorinated cooling tower water are trihalomethanes. This study indicates that up to 2 percent of the added chlorine may be converted to trihalomethanes, and that chloroform would constitute approximately half of these trihalomethanes. For the purpose of a conservative emissions estimate, it can be assumed that 2 percent of the added chlorine will be converted to trihalomethanes, that all formed trihalomethanes will be emitted to the atmosphere, and that chloroform will be the sole constituent in these emissions. Application of these assumptions yields the chloroform emission estimate given in Table 5.1-4.

Water vapor emissions from the cooling towers could cause visible plumes to form. In the assessment of atmospheric effects from power plants, visible plumes caused by the emissions of water vapor from cooling towers are a consideration. Possible adverse effects of visible plumes can include both ground fog and ice formation on surfaces. Calculations of visible plume impacts from cooling towers were conducted for different combinations of temperature and relative humidity. Low temperatures, high relative humidities, low wind speeds, and stable conditions would each increase the chance of a long visible plume. Results show that for low relative humidities and high temperature, characteristic of summer conditions, the visible plume length and height were approximately 41 and 60 meters, respectively. During winter conditions, characterized by low temperatures and high relative humidity, the visible plume length and height were 488 and 269 meters, respectively. These worst-case winter-time plume dimensions are similar to those reported in a study of mechanical draft cooling tower plumes (during fall and winter) from the Potomac

Electrical Power Company's Benning Road Generation Station (Meyer et al. 1975). Since these downwind distances are within or adjacent to plant boundaries, areas such as Highway 93 are sufficiently distant so that ground fog and icing should not be a problem.

Environmental effects of drift deposition on ground surfaces and vegetation from the cooling towers should be minimal except in the immediate vicinity of towers. Hanna et al. (1982) reported that drift deposition effects are at a maximum within 200 meters from the towers. Other investigators have reported observed maximum deposition to occur between 30 and 300 meters downwind (Alkezweeny et al. 1975), while Roffman and Gimble (1975) found that maximum daily deposition levels occurred within 330 meters downwind from the tower.

Fuel Oil Storage. One 50,000-gallon diesel-fuel storage tank would service an auxiliary boiler and provide fuel for plant start-ups. The associated process piping would contain approximately two pumps, six valves, and 24 flanges. Volatilization losses from the transfer and storage of diesel fuel, and fugitive losses from the associated pumps, valves, and flanges will result in hydrocarbon emissions. Estimates of these emissions were calculated using EPA-approved methods (EPA 1985a, 1986a). Twelve plant start-ups per year were assumed of 8 hours' duration each (i.e., 220,000 gallons of fuel consumption). In addition, two weeks of auxiliary boiler operation were assumed (i.e., 150,000 gallons of fuel consumption). The resulting emission estimates are given in Table 5.1-4.

Compliance with Ambient Air Quality Standards. The calculated stack and fugitive (nonstack) emissions of the proposed TSPP at full buildout were modeled with Environmental Protection Agency (EPA)-approved atmospheric dispersion models (EPA 1986C. The highest predicted ambient air pollutant concentrations resulting from the proposed TSPP were used in this analysis since the Nevada air quality standards are not to be exceeded at any time. (Short-term national standards allow one exceedance per year, thus the second-highest predicted concentrations could be used when comparing modeling results against the national standards; this would be less stringent than using the highest predicted concentrations.) The results of this computer modeling, shown in Table 5.1-9, indicate that the proposed project would not cause violations of any applicable national or Nevada ambient air quality standard.

Compliance with New Source Performance Standards (NSPS). Under Prevention of Significant Deterioration (PSD) requirements, the proposed project is required to install BACT. For the applicable pollutants, the proposed BACT limitations for the TSPP project are more stringent than the NSPS for coal-fired power plants. Therefore, the proposed TSPP would be in compliance with NSPS requirements.

Compliance with Prevention of Significant Deterioration (PSD) Requirements. In addition to complying with ambient air quality standards, the proposed

Table 5.1-9. MAXIMUM PREDICTED GROUND-LEVEL CONCENTRATIONS FROM TSPP WITH EIGHT UNITS IN OPERATION ($\mu g/m^3$)

Pollutant and Averaging Period	TSPP[a]	Background[b]	Total	National Ambient Air Quality Standards (Primary)[c]	National Ambient Air Quality Standards (Secondary)[c]	Nevada Ambient Air Quality Standards[c]
Sulfur dioxide						
3-hour	610.3	44.0	654.3	--	1300	1300
24-hour	100.4	13.0	113.4	365	365	365
Annual	9.9	3.0	12.9	80	80	80
Total Suspended Particulate Matter						
24-hour	26.4	44.7	71.1	150[d]	150[d]	150[d]
Annual	6.5	16.6	23.1	50[d]	50[d]	75[d]
Oxides of Nitrogen						
Annual	24.8	2.0	26.8	100	100	100
Carbon Monoxide						
1-hour	728.9	1142.0[e]	1870.9	40,000	40,000	40,000
8-hour	270.3	1142.0[e]	1412.3	10,000	10,000	6,670

[a] Highest predicted short-term concentration used in analysis because short-term Nevada standards do not allow any exceedances at any time.

[b] Maximum measured sulfur dioxide and oxides of nitrogen concentrations at plant site from 1981 to 1982; Maximum measured TSP concentrations at plant site from 1988 to 1989; carbon monoxide not measured.

[c] Short-term national standards (24 hours or less) are not to be exceeded more than once per year. Short-term Nevada standards are not to be exceeded at any time.

[d] National ambient particulate standards are for particulate matter below 10 micrometers in diameter (PM_{10}), while Nevada ambient particulate standards are for total suspended particulate matter (TSP).

[e] Source: Johnson (1989).

project must also comply with PSD requirements. These include documentation that the proposed air pollution control system constitutes BACT; an air quality impact analysis demonstrating that, along with the ambient air quality standards, allowable air quality increments would not be exceeded; and a demonstration of no adverse impact on "air quality related values" (AQRVs) in Class I areas. The results of each of these analyses are summarized below for the proposed project.

Best Available Control Technology. In accordance with the EPA PSD regulations, the following pollutants from the proposed TSPP are subject to BACT requirements: SO_2, NO_x, PM, CO, lead (Pb), beryllium (Be), mercury (Hg), fluorides, and sulfuric acid mist. An evaluation of alternative air pollution control technologies for the proposed TSPP was performed in a "Top-Down" fashion, as stipulated in recent EPA guidelines concerning BACT (EPA 1989a). That is, the most stringent control technology available for a similar source or source category was first identified for each pollutant. Then, for each pollutant, the most stringent control technology was evaluated for its technical, energy, environmental, and economic feasibility with respect to the proposed project. If this technology was concluded to result in unreasonable energy, environmental, or economic impacts on the proposed project, the next most stringent level of control was evaluated. This process continued until the control level under consideration could not be eliminated on any substantial technical, environmental, or economic basis.

The alternative control technology analysis described above resulted in the identification of proposed BACT levels for the TSPP project. It should be noted that the control technology analysis accompanying this EIS is not intended to be a complete BACT analysis. Such an analysis will be submitted with the proposed project's PSD permit application to the NDEP, and the authority to establish final BACT emission limitations is with the NDEP. The proposed emission limitations presented here are the applicant's current assessment of BACT for the proposed project. Also, as discussed below, BACT would be reviewed by the NDEP for each 250-MW unit prior to each unit's construction. Thus, the BACT levels currently being proposed are for the first 250-MW unit and represent the minimum degree of control that would be applied to subsequent units as they come on-line. BACT determinations for future units would consider any new or improved control technology as it becomes commercially available.

For the proposed TSPP project, BACT for NO_x emissions is proposed to be the use of "Low-NO_x" burners with combustion modifications, BACT for CO is proposed to be proper burner and combustion chamber design, BACT for SO_2 is proposed to be a lime spray-dryer (dry scrubber) followed by a baghouse (fabric filter system), BACT for PM is proposed to be a baghouse (fabric filter system), and BACT for all other pollutants is proposed to be the lime spray-dryer/baghouse system. The application of these technologies is projected to achieve the following levels of control:

- SO_2 - 0.18 lbs/MMBtu
- NO_x - 0.45 lbs/MMBtu
- PM - 0.015 lbs/MMBtu
- CO - 0.12 lbs/MMBtu
- Pb - 96 percent control
- Be - 96.7 percent control
- Hg - 70 percent control
- Fluorides - 90 percent control
- Sulfuric acid mist - 86 percent control

Section 3.2.3.6 provides a discussion of the alternative control technologies that were considered. The evaluation of alternative control technologies is summarized in Tables 5.1-10 through 5.1-13. This evaluation included previous BACT and LAER (lowest achievable emission rate[1]) determinations for permitted utility boilers with the following characteristics:

- Pulverized coal-fired power plant
- Western coal fuel
- Capacity of 200 MW or more
- Permit issued after January 1, 1980

Ambient Air Impact Analysis. Figure 5.1-1 shows the annual 1-$\mu g/m^3$ concentration isopleths for SO_2 and NO_2 resulting from the proposed TSPP with all eight 250-MW units in operation. These isopleths represent the distance to the 1-$\mu g/m^3$ significance impact limit, as defined by the EPA. At distances beyond these isopleths the EPA would not consider the TSPP as contributing significantly to the degradation of ambient air quality levels. A 1-$\mu g/m^3$ isopleth is not shown for particulate matter because the maximum annual particulate matter impacts resulting from emission from the TSPP boiler stacks would be less than 1-$\mu g/m^3$ (see Table 5.1-9). Although the coal-, ash-, and lime-handling operations would exceed 1-$\mu g/m^3$, these impacts would be restricted to the immediate vicinity of the facility, and therefore are not shown in Figure 5.1-1.

As stated earlier, the proposed project is not expected to cause an exceedance of any ambient air quality standard. The air quality increment analysis performed for the proposed project is summarized below.

The projected air quality increment consumption from the proposed TSPP was computed using EPA-approved atmospheric dispersion modeling techniques. Air quality increments are allowable increases in ambient air pollutant concentrations over baseline concentration levels, which, in the

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[1] LAER is an emission standard more stringent than BACT, intended for major sources proposing to locate in areas in "nonattainment" of ambient air quality standards. The proposed TSPP would be locating in an "attainment" area, thus BACT applies to the TSPP project.

Table 5.1-10. PROPOSED SO_2 BACT LIMITATION FOR TSPP IN COMPARISON WITH ALTERNATIVE TECHNOLOGY AND RECENT BACT/LAER DETERMINATIONS FOR 200 MW OR GREATER PULVERIZED COAL-FIRED POWER PLANTS

Project/ Alt. Tech.	Date of Permit	Capacity	SO_2 Limit	SO_2 Control Technology	Cost/Ton Reduced	Applicable to TSSP	Impacts/Limitations
Proposed TSPP	--	8x250 MW	0.18 lb/MMBTU (84-89% control[a])	Dry FGD[b]	$1000[d]	Yes	High lime requirement Dry waste product
Alternative Technology	--	--	90% control	FBC[c]	NA[e]	No	Unproven for boilers >100MW. Scale-up difficulties.
Intermountain Power	12/85	2x700 MW	0.15 lb/MMBTU	Wet scrubber	$1100[d]	No[f]	High water consumption Liquid waste product
White Pine Power	11/82	2x750 MW	0.19 lb/MMBTU	Dry FGD[b]	$1000[d]	Yes	High lime requirement Dry waste product
Washington Water Power	11/82	2,080 MW	0.22 lb/MMBTU	Not stated	--	--	--
Plains Electric Generator	5/81	210 MW	0.20 lb/MMBTU	Dry FGD[b]	$1000[d]	Yes	High lime requirement Dry waste product
Nevada Power Co. (Harry Allen Station)	4/81	4x560 MW	0.10 lb/MMBTU	Wet scrubber	$1100[d]	No[f]	High water consumption Liquid waste product
Utah Power & Light (Hunter Station)	6/80	1,600 MW	0.12 lb/MMBTU	Wet scrubber	$1100[d]	No[f]	High water consumption Liquid waste product
Intermountain Power	6/80	3,000 MW	0.15 lb/MMBTU	Wet scrubber	$1100[d]	No[f]	High water consumption Liquid waste product
Platte River Power (Rawhide Project)	5/80	250 MW	0.13 lb/MMBTU	Dry FGD[b]	$1000[d]	Yes	High lime requirement Dry waste product
Tucson Electric Power (Unit #3)	4/80	350 MW	0.22 lb/MMBTU	Dry FGD[b]	$1000[d]	Yes	High lime requirement Dry waste product
Desert Generator & Trans. (Loon Lake)	2/80	800 MW	0.055 lb/MMBTU	Wet scrubber	$1100[d]	No[f]	High water consumption Liquid waste product

[a] Depends on type of coal.
[b] Dry flue gas desulfurization.
[c] Fluid bed combustion.
[d] Approximate.
[e] Insufficient costing data; dependent on combustor design.
[f] Insufficient water at TSPP site.

Sources: EPA 1985, 1986, 1987, 1988

Table 5.1-11. PROPOSED NO_x BACT LIMITATION FOR TSPP IN COMPARISON WITH ALTERNATIVE TECHNOLOGY AND RECENT BACT/LAER DETERMINATIONS FOR 200 MW OR GREATER PULVERIZED COAL-FIRED POWER PLANTS

Project/ Alt. Tech.	Date of Permit	Capacity	NO_x Limit	NO_x Control Technology	Cost/Ton Reduced	Applicable to TSSP	Impacts/Limitations
Proposed TSPP	--	8x250 MW	0.45 lb/MMBTU (55% control)	Low NOx, combustion modific.	<$100	Yes	No adverse impacts
Alternative Technology	--	--	80% control	SCR[a]	NA[d]	No	Unproven on U.S. coal-fired boiler.
Alternative Technology	--	--	70% control	NCRA[b]	$1200[e]	No	No operating experience on utility-sized coal-fired boiler. Significant potential for ammonia slip.
Alternative Technology	--	--	50-80% control	NCRU[c]	$1350[e]	No	No operating experience on utility-sized coal-fired boiler.
Intermountain Power	12/85	2x700 MW	0.55 lb/MMBTU	Low NOx, combustion modific.	<$100	Yes	No adverse impacts
White Pine Power	11/82	2x750 MW	0.55 lb/MMBTU	Combustion control	<$100	Yes	No adverse impacts
Washington Water Power	11/82	2,080 MW	0.5 lb/MMBTU	Not stated	--	--	No adverse impacts
Plains Electric Generator	5/81	210 MW	0.45 lb/MMBTU	Combustion control	<$100	Yes	No adverse impacts
Nevada Power Co. (Harry Allen Station)	4/81	4x560 MW	0.44 lb/MMBTU	Low NOx, combustion modific.	<$100	Yes	No adverse impacts
Utah Power & Light (Hunter Station)	6/80	1,600 MW	0.55 lb/MMBTU	Boiler design	<$100	Yes	No adverse impacts
Intermountain Power	6/80	3,000 MW	0.55 lb/MMBTU	Boiler design	<$100	Yes	No adverse impacts
Platte River Power (Rawhide Project)	5/80	250 MW	0.5 lb/MMBTU	Boiler design	<$100	Yes	No adverse impacts
Tucson Electric Power (Unit #3)	4/80	350 MW	0.44 lb/MMBTU	Combustion modific.	<$100	Yes	No adverse impacts

Table 5.1-11. PROPOSED NO_x BACT LIMITATION FOR TSPP IN COMPARISON WITH ALTERNATIVE TECHNOLOGY AND RECENT BACT/LAER DETERMINATIONS FOR 200 MW OR GREATER PULVERIZED COAL-FIRED POWER PLANTS (concluded)

Project/ Alt. Tech.	Date of Permit	Capacity	NO_x Limit	NO_x Control Technology	Cost/Ton Reduced	Applicable to TSSP	Impacts/Limitations
Desert Generator & Trans. (Loon Lake)	2/80	800 MW	0.55 lb/MMBTU	Boiler design	<$100	Yes	No adverse impacts

[a] SCR = Selective Catalytic Reduction
[b] NCRA = Noncatalytic Reduction with Ammonia
[c] NCRU = Noncatalytic Reduction with Urea
[d] No U.S. data available.
[e] Approximate.

Sources: EPA 1985, 1986, 1987, 1988

Table 5.1-12. PROPOSED PM BACT LIMITATION FOR PROPOSED TSPP IN COMPARISON WITH RECENT BACT/LAER DETERMINATIONS FOR 200 MW OR GREATER PULVERIZED COAL-FIRED POWER PLANTS

Project/ Alt. Tech.	Date of Permit	Capacity	PM Limit	PM Control Technology	Cost/Ton Reduced	Applicable to TSSP	Impacts/Limitations
Proposed TSPP	--	8x250 MW	0.015 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Intermountain Power	12/85	2x700 MW	0.02 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
White Pine Power	11/82	2x750 MW	0.02 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Washington Water Power	11/82	2,080 MW	0.03 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Plains Electric Generator	5/81	210 MW	0.03 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Nevada Power Co. (Harry Allen Station)	4/81	4x560 MW	0.015 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Utah Power & Light (Hunter Station)	6/80	1,600 MW	0.03 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Intermountain Power	6/80	3,000 MW	0.02 lb/MMBTU	Electrostatic Precipitator	NA	No	Baghouse is strongly preferred with dry FGD
Platte River Power (Rawhide Project	5/80	250 MW	0.026 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Tucson Electric Power (Unit #3)	4/80	350 MW	0.026 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts
Desert Generator & Trans. (Loon Lake)	2/80	800 MW	0.03 lb/MMBTU	Baghouse	NA	Yes	No adverse impacts

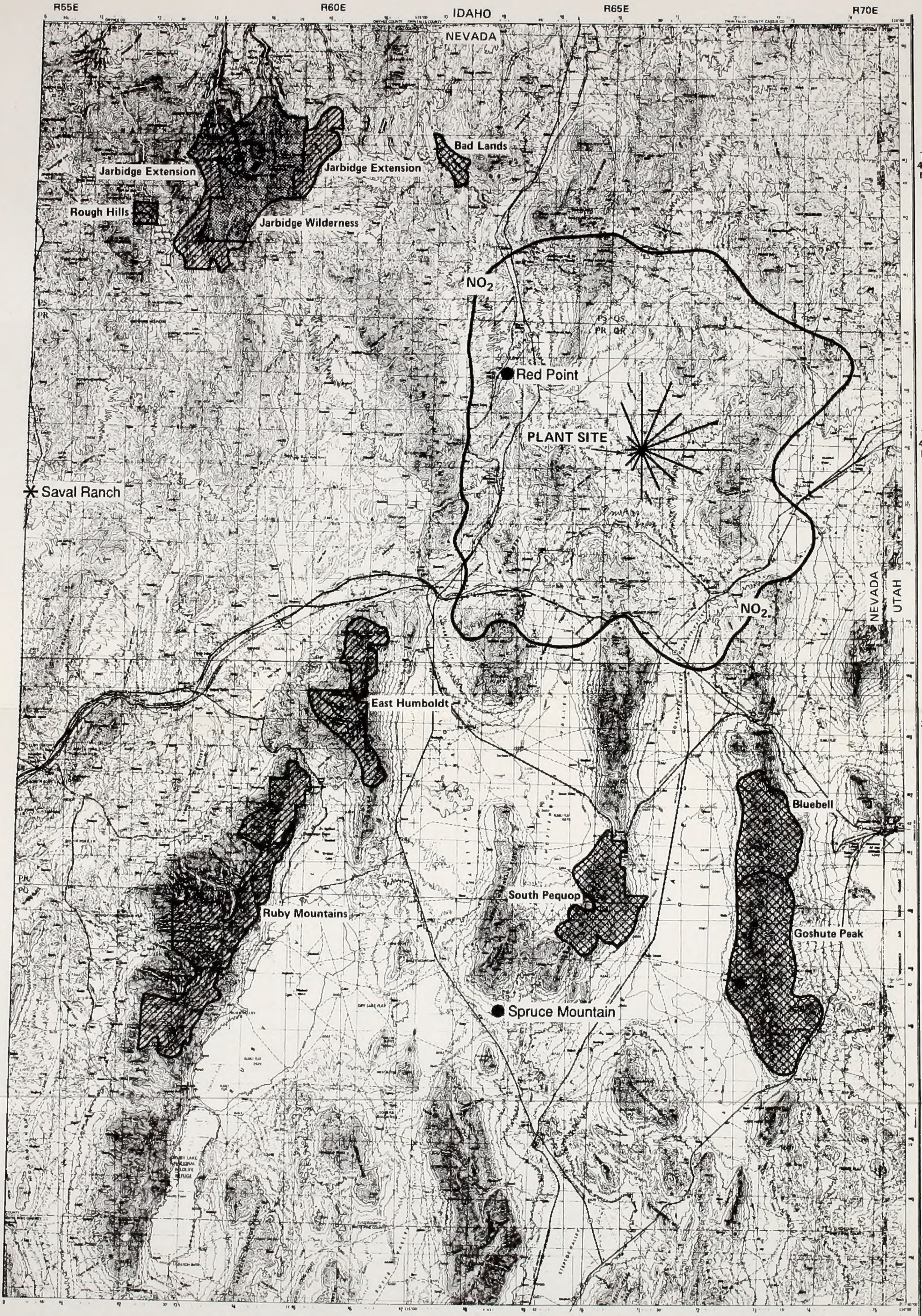
Sources: EPA 1985b, 1986b, 1987, 1988c

Table 5.1-13. PROPOSED CO BACT LIMITATION FOR TSPP IN COMPARISON WITH ALTERNATIVE TECHNOLOGY AND RECENT BACT/LAER DETERMINATIONS FOR 200 MW OR GREATER PULVERIZED COAL-FIRED POWER PLANTS

Project/ Alt. Tech.	Date of Permit	Capacity	CO Limit	CO Control Technology	Cost/Ton Reduced	Applicable to TSSP	Impacts/Limitations
Proposed TSPP TSPP	--	8x250 MW	0.12 lb/MMBTU (100 ppm)	Proper design	Low	Yes	Lower CO limit at expense of higher NO_x emissions.
Alternative Technology	--	--	10 ppm	Catalyst	High	No	Catalyst subject to poisoning by coal combustion by-products. Unproven on coal-fired utility boiler.
Intermountain Power	12/85	700 MW	NA[a]	NA[a]	NA	NA	NA
White Pine Power	11/82	2x750 MW	0.05 lb/MMBTU	Not stated	NA	NA	NA
Washington Water Power	11/82	2,080 MW	0.16 lb/MMBTU	Not stated	NA	NA	NA
Plains Electric Generator	5/81	210 MW	0.063 lb/MMBTU	Combustion control	Low	Yes	Not Known
Nevada Power Co. (Harry Allen Station)	4/81	4x560 MW	0.04 lb/MMBTU	Proper design	Low	Yes	Not Known
Utah Power & Light (Hunter Station)	6/80	1,600 MW	NA[a]	NA[a]	NA	NA	NA
Intermountain Power	6/80	3,000 MW	0.04 lb/MMBTU	Not shown	Low	NA	NA
Platte River Power (Rawhide Project)	5/80	250 MW	NA[a]	NA[a]	NA	NA	NA
Tucson Electric Power (Unit #3)	4/80	350 MW	NA[a]	NA[a]	NA	NA	NA
Desert Generator & Trans. (Loon Lake)	2/80	800 MW	No limit	No control	NA	NA	NA

[a] No BACT determination made.

Sources: EPA 1985b, 1986b, 1987, 1988c



LEGEND

Class I Wilderness Area

USFS Wilderness Areas

BLM Wilderness Study Area

BLM RAWS Site

NADP/NTN Monitoring Station

Flow Vector Wind Rose for 100-Meter Winds

0 10 20 miles

-N-

Figure 5.1-1. ANNUAL 1 μg/m^3 CONCENTRATION ISOPLETHS FOR SO_2 AND NO_2 FROM TSPP, EIGHT 250 MW UNITS IN OPERATION

case of the proposed TSPP, are existing background levels. Methodologies followed for this increment analysis were those outlined by EPA PSD guidance documents. Increment consumption was evaluated in both the relatively flat terrain immediately surrounding the proposed plant site and within the mountainous regions at further distances from the plant site. Air emission sources evaluated in this analysis included boiler emissions, cooling tower emissions, and emissions from coal-, lime-, and solid waste-handling operations.

A screening procedure was used on the cooling towers and the coal-, ash-, and lime-handling operations based on the Industrial Source Complex Short Term (ISCST) model. This procedure provided a highly conservative estimate of potential air quality impacts from these proposed systems. The method incorporates the use of 49 theoretical wind speed and atmospheric stability categories, modeling the maximum downwind impacts for each wind speed/stability combination.

Emissions from the boiler stacks were modeled using the ISCST, COMPLEX I, and Rough Terrain Dispersion Model (RTDM) models. These models were run using the boiler stack information discussed in Section 3.1.2.4. One year of on-site meteorological data was used in conjunction with these models to compute short- and long-term average concentration increases. Both the COMPLEX I and RTDM models were used for the elevated terrain analysis. The RTDM model incorporates the latest EPA-approved algorithms for modeling the physical movement of a plume over and around a hillside. Impacts within the elevated terrain incorporated only boiler emissions, since particulate concentrations from fugitive dust sources associated with the coal-, ash-, and lime-handling operations would drop out well before reaching the high terrain areas.

As depicted in Figure 5.1-1, the maximum predicted short- and long-term concentrations from the TSPP boiler stacks, with all eight units in operation, occur in elevated terrain approximately 7 miles east-southeast of the proposed plant site, at an elevation of about 6500 feet. Maximum short-term concentrations at this location occurred during stable atmospheric conditions and low windspeeds. The maximum predicted particulate concentrations from the coal-, ash-, and lime-handling operations and cooling towers occur within the fenceline of the facility during neutral atmospheric stability conditions and high windspeeds. Since the particulate emissions from the coal-, ash-, and lime-handling operations would be released at a relatively low height above the ground, maximum predicted concentrations would occur within close proximity to the source before any significant dispersion took place. Particulate emissions from the boilers would be released from 450-foot stacks. Although the amount of particulate matter released through the boiler stacks would be much higher than that generated by the material-handling operations, significant mixing of the stack plume would occur before the plume impinged on any land surface, resulting in lower concentrations than from the coal-, ash-, and lime-handling operations.

For the air quality increment analysis, the second-highest modeled short-term concentration increase at any receptor (except for the 24-hour average particulate concentration) was identified as well as the maximum annual average concentration. The second-highest modeled concentration increases may be used in the short-term analyses since the EPA PSD regulations allow one exceedance per year for the short-term increments. The results of the Class II increment analysis are shown in Table 5.1-14 along with the applicable Class II increments.

Table 5.1-14 shows Class II increment consumption for total suspended particulate matter (TSP) and nitrogen dioxide (NO_2) to be within allowable limits for the proposed TSPP at full buildout (i.e., eight 250-MW generating units) with current proposed BACT emission limits. For SO_2, the analysis shows that emissions from all eight units, each with SO_2 controls at the proposed BACT level of 0.18 lb SO_2/MMBtu, would result in the protection of all applicable increments, except the Class II 24-hour increment. The exceedance of this increment would be a significant air quality impact. In addition, based on the modeled pollutant concentrations, exceedances could occur during startup/shutdown and/or upset conditions. However, it should be noted that the TSPP project is proposed to be a "phased construction" project, and the PSD regulations require that the determination of BACT be reviewed prior to the implementation of each independent construction phase. The TSPP project consists of eight individual construction phases that would take place over a period of approximately 20 years. Table 5.1-15 shows that the current proposed BACT level of 0.18 lb SO_2/MMBtu, when applied to the first seven steam-generating units, results in maximum ground-level concentrations below the Class II 24-hour SO_2 increment. In order to protect the 24-hour increment when all eight units are operational, the seventh and eighth units would need a level of control equivalent to 0.16 lb SO_2/MMBtu, according to the air quality analysis, resulting in a 24-hour-average concentration of 90.4 $\mu g/m^3$ (see footnote in Table 5.1-14). The seventh and eighth units would be required to meet more stringent emission controls than the first six units to ensure the Class II 24-hour SO_2 increment would be protected. Demonstration of increment protection is a condition of the NDEP's issuance of a PSD permit.

Although the proposed TSPP project would be close to the increment limits for SO_2 and NO_2, this would not preclude other industrial sources from locating in the area for the following reasons. First, sources that are not major sources (i.e., PSD sources) do not have to comply with increment limits. Therefore, as long as ambient air quality standards would not be violated, other non-PSD sources could locate in the area. They would have to be permitted by the NDEP and would have to demonstrate that their emissions in conjunction with other sources (including TSPP), when added to background concentrations, would not exceed the ambient air quality standards. Second, as discussed in Section 4.1.3.2, the available air quality increment depends on how much other sources have reserved at any given location. Although the proposed TSPP would, at the location of maximum concentration, consume most of the allowable SO_2 and NO_2 increments

Table 5.1-14. COMPARISON OF INCREMENTS CONSUMED BY TSPP (EIGHT UNITS OPERATING) WITH CLASS II INCREMENTS

Pollutant and Averaging Period	Concentration Increase Due To Project ($\mu g/m^3$)	Class II[a] Increment ($\mu g/m^3$)
Sulfur Dioxide		
3-hour	485.1[b]	512
24-hour	93.0[b,c]	91
Annual	9.9	20
Particulate Matter		
24-hour	26.4	37
Annual	6.5	19
Oxides of Nitrogen		
Annual	24.8	25

[a] Short-term PSD increments (24 hours or less) are not to be exceeded more than once per year, at any location.

[b] Second highest predicted short-term concentration used in analysis because short-term PSD increments allow one exceedance per year.

[c] Predicted 24-hr SO_2 concentration increase of 93.0 $\mu g/m^3$ based on SO_2 emissions of 0.18 lb/MMBtu per unit at full buildout (i.e., 8 units). If SO_2 emissions from the first six units were 0.18 lb/MMBtu and from the last two units were 0.16 lb/MMBtu (or equivalent level of control), then predicted 24-hr SO_2 concentration increase would be 90.4 $\mu g/m^3$.

Table 5.1-15. COMPARISON OF INCREMENTS CONSUMED AS EACH UNIT COMES INTO OPERATION WITH CLASS II INCREMENT LIMITS (BOILER EMISSIONS ONLY)

Pollutant	Receptor X (km)	Receptor Y (km)	Receptor Elev. (ft)	Distance from TSPP (km)	Modeled Concentration ($\mu g/m^3$) Number of Units 1	2	3	4	5	6	7	8	PSD CLASS II Increment ($\mu g/m^3$)
Sulfur Dioxide													
3-hr	718.8	4577.5	6440	12.9	60.6	121.3	181.9	242.6	303.0	363.8	424.5	485.1	512
24-hr	718.8	4577.8	6440	12.9	11.6	23.3	34.9	46.5	58.1	69.8	81.4	93.0	91
Annual	715.8	4574.9	6440	10.6	1.2	2.5	3.7	5.0	6.2	7.5	8.7	9.9	20
Oxides of Nitrogen													
Annual	715.8	4574.9	6440	10.6	3.1	6.2	9.3	12.4	15.5	18.6	21.7	24.8	25
Particulate Matter													
24-hr	718.8	4577.5	6440	12.9	1.0	2.0	2.9	3.9	4.9	5.9	6.9	7.9	37
Annual	715.8	4574.9	6440	10.6	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	19

[a] Emissions based on 0.18 lb SO_2/MMBtu for all units.

at that point, it would not be consuming these increments at all locations in the region. This means that as long as another PSD source, in conjunction with TSPP, does not exceed the increment limits at other locations, it could be located in the same region. However, if another PSD source were to locate in proximity to the TSPP, that source could be required to purchase offsets for SO_2 and/or NO_2 from TSPP in order to be constructed and operated.

Because Jarbidge Wilderness Area is a Class I area, a Class I increment analysis was also performed. Concentration increases from the proposed TSPP project were computed in Jarbidge Wilderness Area using the EPA-approved RTDM model. For this modeling, a 1-kilometer (km) receptor grid was used. Receptors locations were situated within and along the borders of Jarbidge Wilderness Area extending into the wilderness area up to a northeast-southwest oriented ridge line (elevation between approximately 8000 and 9000 feet). This ridge line defines for this analysis the furthest limit of the terrain to be modeled in RTDM. Based on preliminary modeling results, the plume height in the Jarbidge Wilderness occurred at elevations between 6000 and 7000 feet. Thus, the receptor grid includes terrain where plume impaction may occur. Figure 5.1-2 shows the Class I Jarbidge Wilderness Area and the Wilderness Area addition, along with the receptor grid used for the air quality modeling.

The modeling results for the Class I increment analysis are shown in Table 5.1-16. Based on the RTDM modeling results, the maximum modeled short-term (3- and 24-hour) ground-level concentrations are shown to be above the Class I increment limits. Maximum modeled concentrations predict increment exceedances for twelve 3-hour periods and seven 24-hour periods. However, for short-term averaging periods, the RTDM model may significantly overpredict impacts in the Jarbidge Wilderness Area due to the inherent limitations in the model described below. Because of this, those periods for which Class I increment exceedances were predicted were evaluated using trajectory analysis methods. In addition to the modeled Class I increment exceedances, four 3-hour periods where the modeled concentration was near the increment limit were also evaluated. Tables 5.1-17 and 5.1-18 provide the modeled concentrations in the Jarbidge Wilderness Area that were evaluated by trajectory analysis. The locations where the short-term modeled concentrations exceeded the increment are shown in Figure 5.1-2.

Because the distance from the proposed TSPP site to the closest boundary of Jarbidge is about 75 km, the meteorological conditions during which high concentrations could occur (i.e., persistence of winds towards Jarbidge during stable conditions and light windspeeds) are unlikely to exist for a sufficient time period for the plume to be transported directly to the Jarbidge Wilderness Area although the RTDM model computes a concentration for that period assuming instantaneous transport. This is because there is no temporal dependence built into the model. Therefore, for those periods for which increment exceedances were predicted, hourly trajectories were determined and evaluated to see whether the plume could

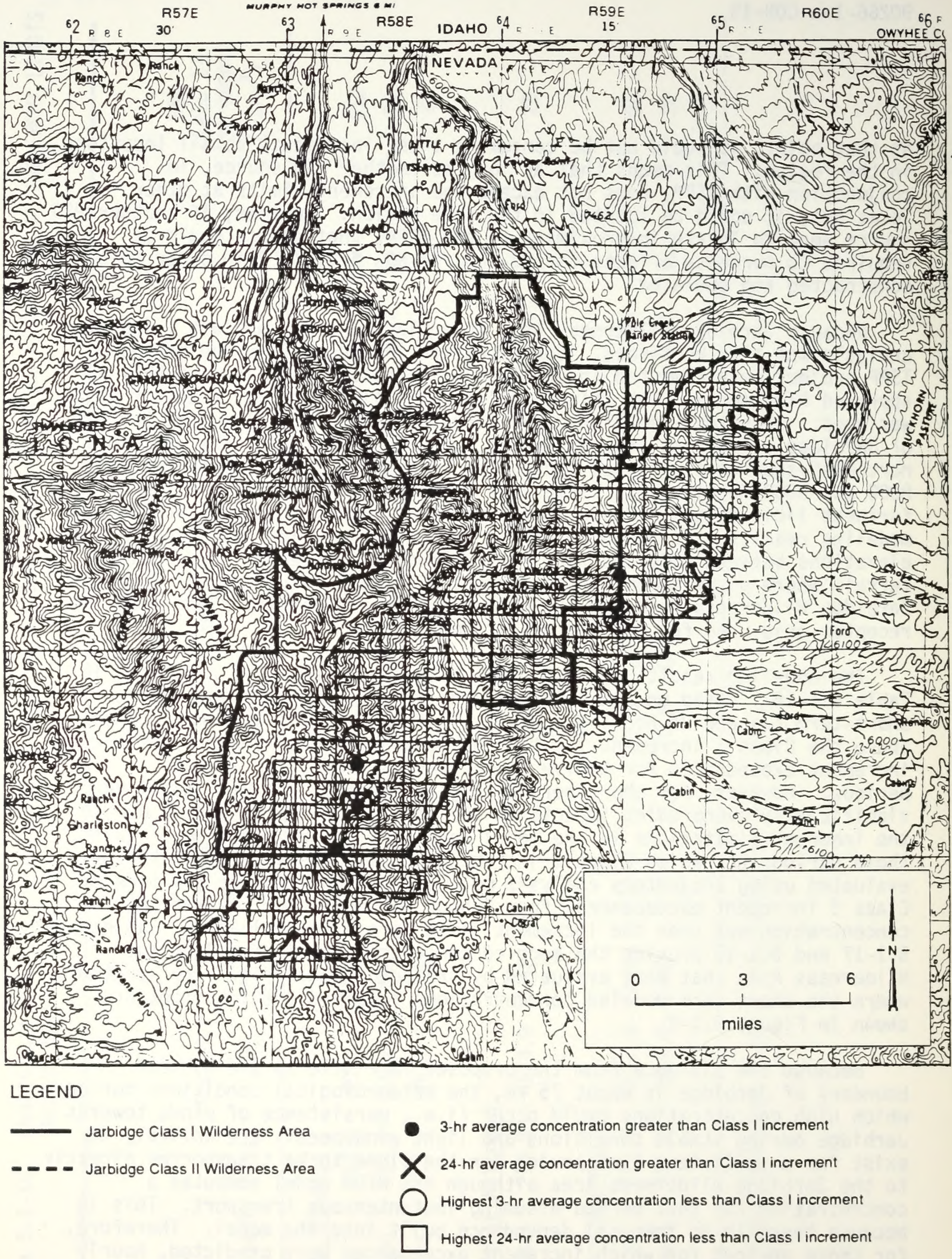


Figure 5.1-2. LOCATIONS OF RECEPTORS IN JARBIDGE WILDERNESS AREA WHERE 3- AND 24-HOUR CONCENTRATIONS EXCEEDED THE CLASS I INCREMENT AND LOCATIONS OF HIGHEST 3- AND 24-HOUR CONCENTRATIONS NOT EXCEEDING THE CLASS I INCREMENT

Table 5.1-16. MAXIMUM MODELED GROUND-LEVEL CONCENTRATIONS FROM TSPP (EIGHT UNITS IN OPERATION) IN JARBIDGE WILDERNESS AREA COMPARED WITH CLASS I INCREMENTS

Pollutant and Averaging Period	Modeled Concentration Increase Due To Project ($\mu g/m^3$)	Class I[a] Increment ($\mu g/m^3$)
Sulfur Dioxide		
3-hour	55.9[b]	25
24-hour	10.7[b]	5
Annual	0.3	2
Particulate Matter		
24-hour	0.7	10
Annual	0.03	5
Nitrogen Dioxide		
Annual	0.8	2.5

[a] Short-term PSD increments (24 hours or less) are not to be exceeded more than once per year, at any location.

[b] Modeled concentration increases shown exceed the Class I increments. Further evaluation by trajectory analysis shows these modeled concentrations could not occur.

Table 5.1-17. MAXIMUM MODELED 3-HOUR AVERAGE SO_2 GROUND-LEVEL CONCENTRATIONS IN JARBIDGE WILDERNESS AREA EVALUATED USING TRAJECTORY ANALYSIS

Day	3-Hour Average Concentration ($\mu g/m^3$)	Location UTM Coordinates x (km)	y (km)
112	47.2	633	4613
113	28.6	647	4625
118	24.8	633	4614
120	27.3	634	4617
129	28.0	633	4613
130	24.7	633	4613
145	55.9	633	4613
154	27.8	633	4613
158	27.3	633	4613
186	27.4	634	4615
220	29.3	633	4613
234	27.1	634	4615
241	27.5	633	4613
280	19.3	647	4624
284	24.3	633	4613
307	55.1	633	4613

Note: Class I 3-Hour SO_2 increment limit is 25 $\mu g/m^3$.

Table 5.1-18. MAXIMUM MODELED 24-HOUR AVERAGE SO_2 GROUND-LEVEL CONCENTRATIONS EXCEEDING 24-HOUR CLASS I INCREMENT IN JARBIDGE WILDERNESS AREA EVALUATED USING TRAJECTORY ANALYSIS

Day	24-Hour Average Concentration ($\mu g/m^3$)	Location UTM Coordinates x (km)	y (km)
112	8.0	633	4613
145	7.0	633	4613
154	5.1	633	4613
162	5.2	647	4624
220	7.9	633	4613
256	10.7	634	4615
307	9.0	633	4613

Note: Class I 24-hour SO_2 increment limit is 5 $\mu g/m^3$.

actually reach Jarbidge, with the necessary persistent conditions, during the averaging period.

For short-term averaging periods, the RTDM model calculates a 3- or 24-hour average concentration by averaging the appropriate number of individual 1-hour concentrations. In general, high 24-hour average concentrations were caused by averaging several 1-hour concentrations during that 24-hour time period. In most instances, these 24-hour concentrations were characterized by non-persistent meteorological conditions. In fact, the maximum number of consecutive hours in a 24-hour averaging period that contributed to a Class I increment exceedance in the Jarbidge Wilderness Area was 3 hours. In all cases, there were intervening periods with meteorological conditions that would transport the plume away from Jarbidge. These intervening hours with changes in wind direction, wind speed, and stability would likely cause additional dispersion unaccounted for by the model, and do not contribute to the high 24-hour average concentrations. In addition, stable atmospheric conditions necessary to cause high concentrations with wind directions towards Jarbidge only persist for a maximum of 3 hours during any of the 24-hour periods evaluated. The model assumes transport to Jarbidge is instantaneous (i.e., the plume travels the 75 km to Jarbidge in 1 hour). However, in all cases where the 24-hour Class I increment was exceeded, the plume would have traveled only a fraction of the distance to the Jarbidge Wilderness Area since persistence of wind direction, wind speed, and stability do not occur for sufficient duration. In some cases, plume material would have to be transported up and over significant terrain barriers in order to reach Jarbidge, and this is unlikely to occur during these persistent stable conditions. If it did, topographically induced turbulence would likely enhance dispersion beyond the amount predicted by the model.

High 3-hour average concentrations, although characterized by 3 hours of persistence of wind direction towards Jarbidge in one case, could not traverse 75 km during the 3-hour time span since the wind speeds needed to transport the plume that distance are insufficient. In most cases of 3-hour trajectories analyzed, only 1 hour significantly contributed to the calculation of the 3-hour average concentrations at Jarbidge. Again, this occurs because the model assumes instantaneous transport to Jarbidge Wilderness Area. In all cases, the plume would not be transported to the receptor where the maximum concentration was computed. Additionally, in all but a few cases the plume would be actually transported away from the Jarbidge Wilderness Area. The results of the trajectory analysis indicate that the short-term increments would not be exceeded. Table 5.1-19 provides the maximum short-term ground-level SO_2 concentrations from TSPP in the Jarbidge Wilderness Area for those periods remaining that were not screened by the trajectory analysis. The locations of these short-term concentrations not exceeding the Class I increment are shown in Figure 5.1-2.

Table 5.1-19. MAXIMUM PREDICTED SHORT-TERM GROUND-LEVEL SO_2 CONCENTRATIONS FROM TSPP (EIGHT UNITS IN OPERATION) IN JARBIDGE WILDERNESS AREA AFTER EVALUATION BY TRAJECTORY ANALYSIS

Averaging Period	Concentration Increase Due To Project ($\mu g/m^3$)	Class I[a] Increment ($\mu g/m^3$)
3-Hour	19.2	25
24-Hour	4.4	5

[a] Short-term PSD increments (24 hours or less) are not to be exceeded more than once per year, at any location.

Air Quality Related Values. As discussed in Section 4.1.3.4, the U.S. Forest Service (USFS) has identified the following AQRVs as being of potential concern in the vicinity of the proposed TSPP project: water, flora, fauna, and visibility (USFS 1989a). Sensitive receptors for each AQRV are lakes (alkalinity) for water, lichens for flora, macrobiotic aquatic insects for fauna, and reduction in visibility (visual range). Limits of acceptable change for these AQRVs are provided in Table 4.1-2. These limits are used as indicators of impact significance in the Jarbidge Wilderness Area and other wilderness areas of concern (Table 4.1-2). Since the Limits of Acceptable Change are related to visibility and acid deposition impacts, they are discussed with respect to the proposed TSPP in the following sections.

Visibility. Plume emissions, especially NO_x and SO_2, can affect visibility in two primary ways: first, by contributing to the problem of "regional haze," the general reduction in all directions of the visibility (perception, contrast, and color accuracy) of distant landmarks; second, by "plume blight," where a plume of emitted material is highly evident visually, by contrast with blue sky or background terrain, or by degradation of terrain/sky contrast as viewed through the plume. At large distances, greater than 100 km, layered haze attributable to specific sources has not been observed (Latimer 1989b).

A major concern in visibility studies is the impact of new facilities on "viewsheds," or vistas and perspectives, from Class I areas, as specified in the Clean Air Act Amendments of 1977. The Class I area closest to the project site is Jarbidge Wilderness to the northwest. A detailed visibility analysis at Jarbidge Wilderness was performed for potential effects of emissions from the proposed TSPP. In addition to this detailed analysis, less detailed visibility analyses were carried out for other proposed wilderness areas, wilderness study areas

As discussed in Section 4.1.2.4 upper level winds in the region are predominantly westerly, while surface level winds are more variable due to localized terrain features. Once emitted, sulfur dioxide, nitrogen oxides, and particulate matter can be transported for long distances. Long range transport of these pollutants may have an effect on visibility in Class I areas beyond 100 kilometers from TSPP, therefore, additional visibility analyses were performed to evaluate possible visibility degrading effects of TSPP emissions on these areas. The primary pollutants of concern with respect to visibility degradation are nitrogen oxides and secondary fine particulate matter formed from gas-to-particle transformation of sulfur dioxide and nitrogen oxides. Due to the high level of control of particulate matter from the stacks, their effect on visibility are less important.

Visibility Impacts in the Jarbidge Wilderness Area. The Jarbidge Wilderness Area, along with other wilderness areas of concern in the region, has been identified as an area where potential plume visibility impacts are of concern. A plume visibility analysis was carried out to

identify the potential magnitude of visual plume impacts from the proposed TSPP on the Jarbidge Wilderness Area.

The analysis was carried out using the EPA plume visibility model PLUVUE (Johnson et al. 1980), as recently modified for application on personal computers (Richards and Hammarstrand 1988), and the techniques and guidance provided in the recently revised "Workbook for Plume Visual Impact Screening and Analysis" (EPA 1988d) were used. The PLUVUE model was used to calculate the optical effects of power plant emissions after they have been transported, dispersed, chemically converted, and deposited. Based on meteorological measurements made at the TSPP site for the period June 15, 1981 to June 14, 1982 (note that of a total of 8760 hours available for the year, 64 hours were missing), a joint frequency distribution of wind speed and wind direction at 100 meters, and stability at 10 meters, was used to estimate the frequency with which the proposed power plant emissions would be carried toward the Jarbidge Wilderness Area. By combining the modeled magnitudes of plume visual impact with the frequencies of occurrence of worst-case dispersion conditions, an analysis of visual impact magnitude and frequency is possible. Such an analysis is called Level-3 plume visibility analysis, the most detailed of three levels of visibility screening recommended by the EPA (1988d).

Figure 4.1-1 shows the location of the Jarbidge Wilderness Area relative to the proposed TSPP site. Jarbidge is a mandatory PSD Class I area, which is afforded visibility protection by Sections 165 and 169A of the Clean Air Act. In the Air Resource Management Program (USFS 1987b) for the Jarbidge Wilderness, the USFS has established limits of acceptable change for visibility. The limit of acceptable change for visibility is a 5 percent visibility change.

The Jarbidge Wilderness Area is approximately 75 km (47 mi) northwest of the TSPP site. Terrain slopes upward from the TSPP site (at approximately 5700 ft msl) to the Class I area (with peaks higher than 10,000 ft msl). Thus, stable drainage flows would not be carried from the proposed plant TSPP site to the Class I area. The Class I area's longest axis (approximately 35 km long) runs in a north-northeast to south-southwest direction from Biroth Ridge at the northeast corner of the wilderness area, through Mary's River Peak (elevation 10,565 ft msl), to the southwest corner of the wilderness area. The short axis of the wilderness area (approximately 15 km wide) lies in the east-southeast to west-northwest direction. The line of sight between Biroth Ridge and Mary's River Peak is a view of USFS-expressed interest. The visibility for this line of sight is currently being monitored.

The azimuths from the TSPP site to the Class I area range from 293 to 313 degrees. The portion of the wilderness closest to the proposed TSPP site is the southeast corner, approximately 75 km distant from the TSPP site. The wind directions that would carry TSPP emissions toward the wilderness subtend a 20 degree angle (113 to 133 degrees). This constitutes 46 percent of the east-southeast cardinal wind direction sector

and 43 percent of the southeast sector. The southeast corner is also located roughly in the center of the angle subtending the Class I area.

This southeast corner of the Class I area was selected as the observer location for the Level-3 plume visibility analysis because impacts at this location would be expected to be worse than at other locations in the Class I area because:

- The southeast corner is closest to the TSPP site, thus dispersion would be the least at this location.
- This corner is relatively low in elevation, allowing the observer to view horizontally across the plume, thus maximizing the plume cross section along the line of sight. Observers at higher elevations (e.g., Biroth Ridge or Mary's River Peak) would be looking down on the plume; thus, impacts would be less for these locations.
- At other locations, a plume material would have to be transported up and over significant terrain barriers. It is unlikely that this would occur under the worst-case stable conditions. If it did, topographically induced turbulence would likely enhance dispersion.
- At this southeast corner, a plume centerline impacting the wilderness area would be relatively close to the observer since this corner is in the middle of the angle subtending the Class I area. Plume visual impacts are larger when the plume material is relatively close to the observer.

Discussed briefly below are descriptions of the analysis of meteorological conditions, and the selection of worst-case dispersion conditions and the estimation of their frequency of occurrence; the PLUVUE model calculations for the selected dispersion conditions; the frequency of occurrence of dispersion conditions along with the plume visual impact calculations to estimate the frequency of occurrence of plume visual impacts in Jarbidge.

The magnitude of plume visual impact is a function of the concentration of optically active species along the observer's line of sight. This concentration is greatest for lines of sight through the plume centerline and for light-wind, stable conditions. Thus, for the analysis of plume visual impacts, such worst-case dispersion conditions are of interest. Wind directions between 113 and 133 degrees would transport emissions between the azimuths of 293 and 313 degrees in the direction of Jarbidge Wilderness Area. As discussed previously, these wind azimuths constitute 46 percent of the east-southeast cardinal wind sector and 43 percent of the southeast sector. If these conditions persisted sufficiently long, TSPP emissions would be transported into the Class I area.

The precise calculation of the frequency of occurrence of plume transport into Jarbidge Wilderness Area would require sophisticated trajectory modeling based on a temporally and spatially varying windfield. Since such windfield measurements are not available, approximations suggested by the EPA Visibility Workbook were made for the purposes of this plume visibility analysis. First, as recommended by the EPA Workbook, if transport times to the Class I area are greater than 12 hours for the given windspeed, it is assumed that the stable plume is not transported into the area. Stable conditions rarely persist longer than 12 hours, and if they did, it is unlikely that the worst-case wind speed and wind direction would persist also. Analysis of the on-site meteorological data for the TSPP site shows that the maximum number of consecutive hours of stable conditions with the wind blowing towards the Jarbidge Wilderness Area was 3 hours. As discussed earlier in this section, transport of the TSPP plume directly to Jarbidge Wilderness would be unlikely. The Level-3 visibility analysis requires the use of the joint frequency distribution of wind speed, wind direction, and stability which does not account for persistence of meteorological conditions and therefore should lead to overprediction of potential visual impacts. Second, for conservatism, no credit is taken for the fact that Jarbidge Wilderness Area is at a higher elevation than the TSPP site. In actuality, flows might be diverted away from the Class I area because of terrain blockage and drainage flows.

As discussed in Section 4.1.2.4, the prevailing wind direction at the 100-meter level is from the west through south quadrant, a wind direction that would carry TSPP emissions away from the Class I area. The portion of the east-southeast and southeast winds (46 percent of the ESE and 43 percent of the SE winds) which would carry emissions toward the Jarbidge Wilderness Area occurs 2.2 percent of the time, much less frequently than the westerly and southwesterly winds.

Inputs were chosen largely from default model specifications. The modeled emissions (37.7, 94.3, and 3.2 tons/day for SO_2, NO_x, and particulate, respectively) are the annual average emissions at the maximum project level (eight units, 2000 MW). In addition, two other cases were modeled to access the change in visibility impacts as the number of units increased from one to eight. The additional cases modeled were for one and four units in operation. Emissions for these cases were proportionally reduced from the eight-unit cases.

Level-3 visibility analysis is designed to estimate the annual frequency of occurrence of plume visual impacts. It is recommended that annual average emissions be used in the Level-3 analysis (Latimer 1989b) to obtain an estimate of the frequency of occurrence of impacts. Although the maximum short-term average emission rate would result in a larger impact, it is felt that such an approach would greatly overestimate the annual frequency of occurrence of plume visual impacts. If all the worst-case combinations of emission rates, wind speed and direction, time of day, ambient ozone, and background visual range were used, one would obtain much higher plume visual impacts than those based on more typical values.

However, the probability of all such conditions occurring at the same time is quite small. Maximum short-term emission rates are recommended for the more conservative Level-1 and -2 plume visibility screening analyses. It is recommended for Level-3 analysis, which is designed to be more realistic, that average emission rates, visual range, and background ozone concentrations be used, rather than extreme values.

Background visual ranges of 144 and 242 km used in the analysis were the average 50th and 90th percentile visual ranges measured as part of the IMPROVE network in Jarbidge Wilderness Area. These annual visual ranges are lower than the 50th and 90th percentile visual ranges of 177 km and 287 km measured at Craters of the Moon in Idaho and the visual ranges of 215 and 326 km measured in Great Basin National Park in Nevada. However, the Jarbidge visual range is almost identical to the visual range (geometric mean of 142 km, 50-percentile of 150 km) determined from nephelometer measurements for the 1981-1982 period at the proposed TSPP site.

Using the guidance provided in the EPA Visibility Workbook, plume visual impacts were evaluated for a range of scattering angles (the angle between the line of sight and the sun) for a plume whose centerline is half a 22.5 degree sector displaced from the observer. Horizontal lines of sight were analyzed to identify worst-case viewing conditions. Non-horizontal lines of sight would have lower impacts associated with them. Because of the orientation of the Class I area with its major axis perpendicular to plume centerline, lines of sight perpendicular to the plume axis and along the Class I area axis were analyzed because they would intersect the most plume material.

Impacts were calculated for a downwind distance of 75 km, the minimum distance between the TSPP site and Jarbidge Wilderness Area. For the reasons stated earlier, this observer location is expected to result in worst-case plume visual impacts because it is the closest point to TSPP, it is at a relatively low elevation, allowing nearly horizontal plume viewing, and plume material does not have to be transported up and over mountains to reach this location.

Seven different worst-case dispersion conditions (combinations of atmospheric stability and windspeed) were modeled using PLUVUE to establish a range of plausible magnitudes of worst-case plume visual impacts. These conditions were selected after an examination of dispersion conditions observed at the proposed TSPP site. This range of dispersion conditions represents nearly an order of magnitude of variation in the dilution factor (defined as the product of the vertical dispersion coefficient and the windspeed).

For these seven dispersion conditions and using background visual ranges of 144 and 242 km, PLUVUE calculated visual range reduction and the plume perceptibility parameter [Delta E]. The values of Delta E are a function of the scattering angle, with maximum impacts for small scattering angles (sun in front of the observer) and smaller impacts for scattering

angles greater than 90 degrees (sun behind the observer). In all cases, the calculated plume visual impact parameters are indicative of an NO_2 plume that is darker and discolored (yellow or brown) compared to the background sky. For eight units in operation, the calculated reduction in visual range (for lines of sight through the plume centerline) for a background visual range of 144 km ranges from 1.2 to 4.2 percent. For a background visual range of 242 km, the calculated visual range reductions, for eight units operating, ranged from 1.1 to 4.4 percent. These are all less than the Jarbidge limit of acceptable change of 5 percent. Plume perceptibility parameter (Delta E) values (eight units in operation) range from 5.4 to 15.5 for a visual range of 242 km and from 6.9 to 18.9 for a background visual range of 144 km, indicative of plumes that could be easily perceptible. The perceptibility threshold is a Delta E of 2 (EPA 1988d). The Delta E for a plume against a viewing background can be used as an indicator of plume perceptibility and atmosphere discoloration; plumes with Delta E's less than 5 would probably be imperceptible, Delta E's between 5 and 10 would be detected as a slight discoloration by most people, and the severity of discoloration would increase with increasing Delta E.

Figures 5.1-3 through 5.1-6 summarize the annual cumulative frequency distributions for visual range reduction and plume perceptibility (Delta E) for eight units in operation. Figures 5.1-3 and 5.1-4 represent the distribution for visual range reduction and plume perceptibility for a background visual range of 144 km. Figures 5.1-5 and 5.1-6 represent the distribution for visual range reduction and plume perceptibility for a background visual range of 242 km.

The worst-case Delta E values occur for light-wind stable conditions and for small scattering angles. During the early morning hours when light-wind stable conditions would be most common, the sun would be in the east. For the typical views in Jarbidge, to the northeast or southwest along the major axis of the Jarbidge Wilderness Area, scattering angles would be quite large for such times of day. Thus, for most viewing conditions, the maximum Delta E values (for small scattering angles) would not apply, and plume impacts would be better characterized by the smaller Delta E values corresponding to scattering angles of 90 to 180 degrees. For these scattering angles with eight units in operation, the Delta E values range from 5.4 to 11.6 and from 7.9 to 15.3 for background visual ranges of 144 and 242 km, respectively.

Although perceptible plumes may occur, their occurrence is expected to be quite infrequent. The results of the visibility analysis indicate that for worst-case dispersion conditions, visual range reduction would be less than the USFS limit of acceptable change of 5 percent visual range reduction. On the basis of assumptions that would maximize both the magnitude and frequency of plume visual impacts, calculations indicate that perceptible, discolored plumes with Delta E values greater than 10 would occur 33 hrs/yr or approximately 1 percent of the daylight hours. It is expected that this estimate is conservative because it does not account for

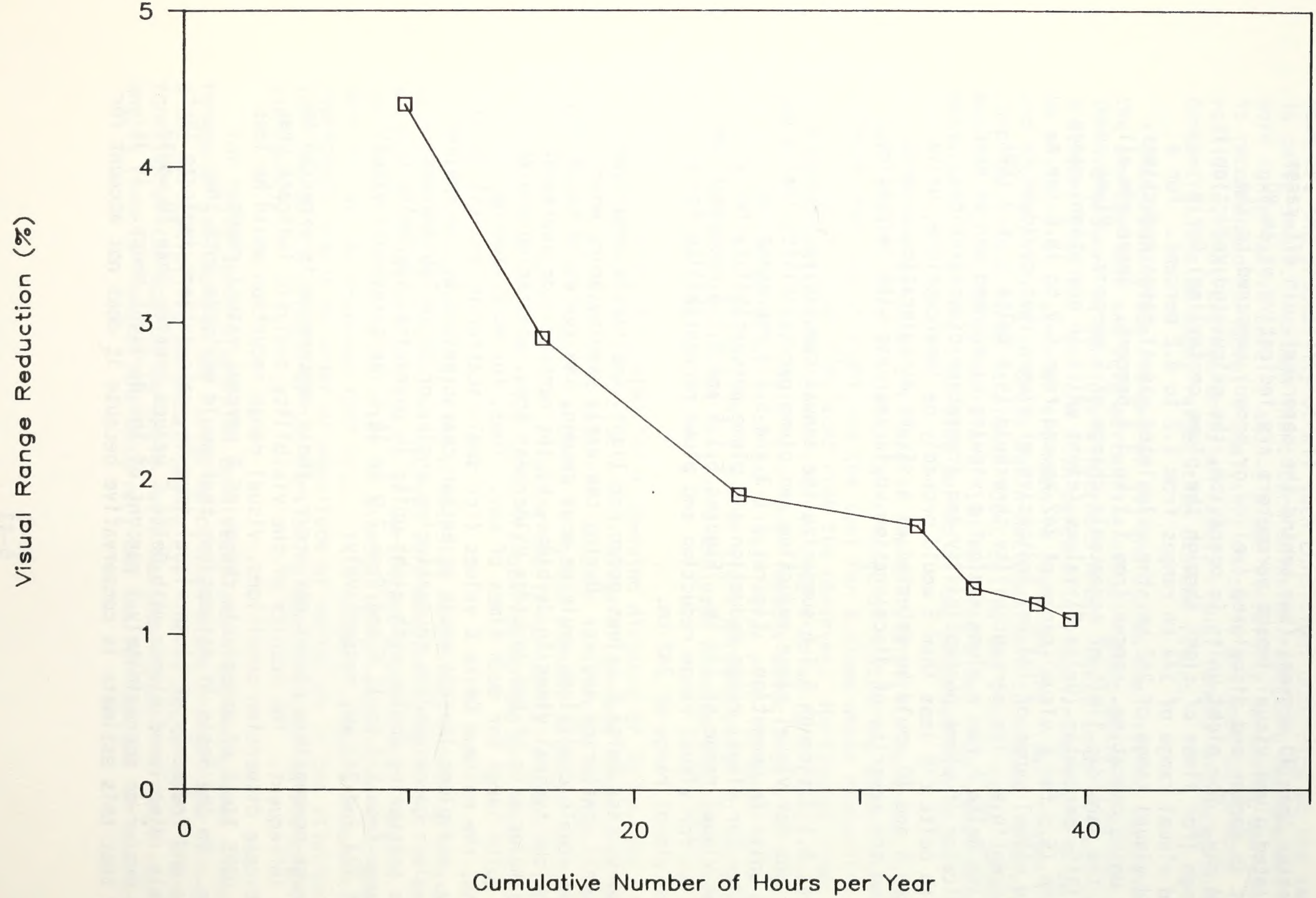


Figure 5.1-3. PREDICTED FREQUENCY OF OCCURRENCE OF VISUAL RANGE REDUCTION (%) IN JARBIDGE WILDERNESS AREA USING A BACKGROUND VISUAL RANGE OF 144 KM

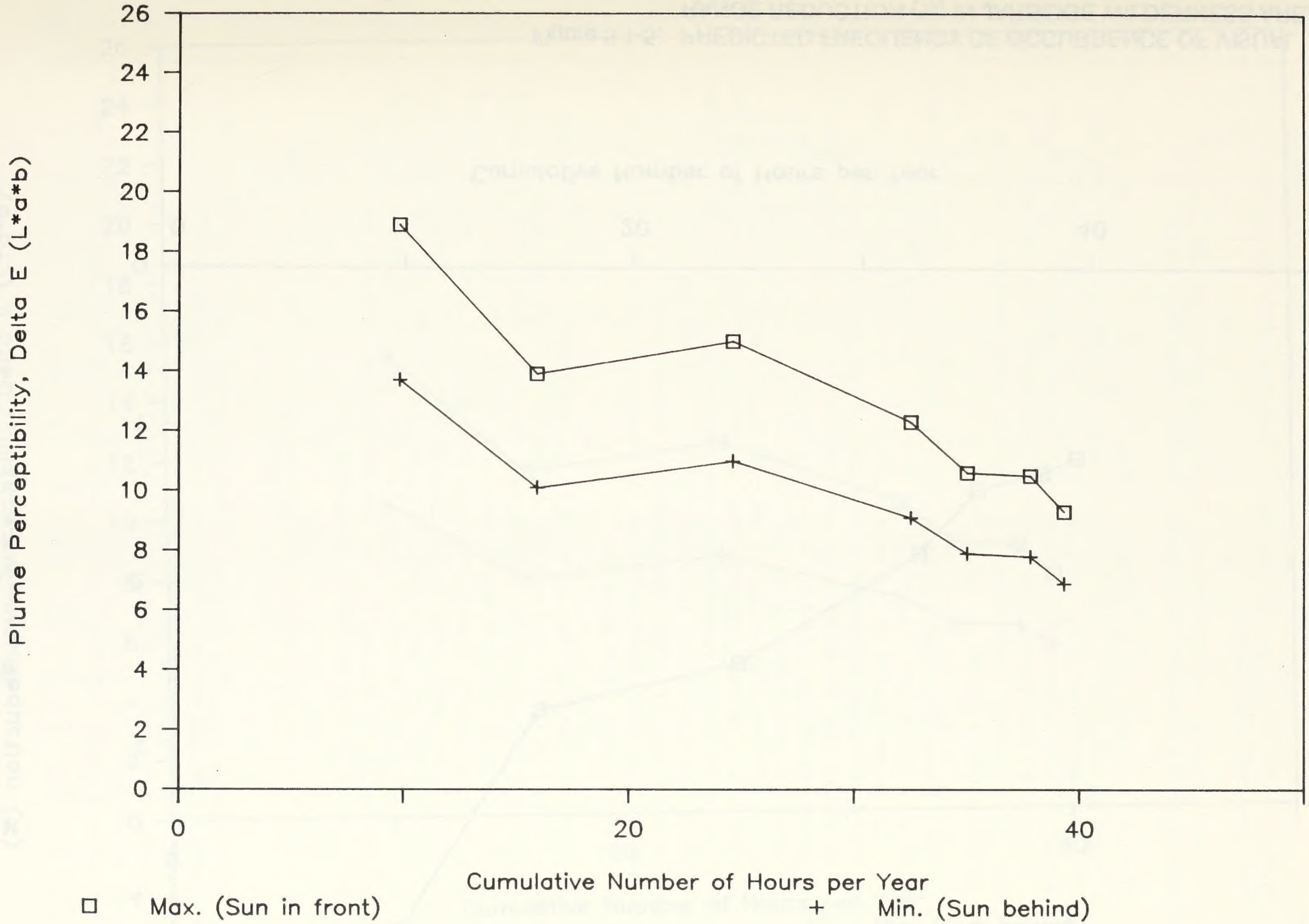


Figure 5.1-4. PREDICTED FREQUENCY OF OCCURRENCE OF PLUME PERCEPTIBILITY IN JARBIDGE WILDERNESS AREA USING A BACKGROUND VISUAL RANGE OF 144 KM

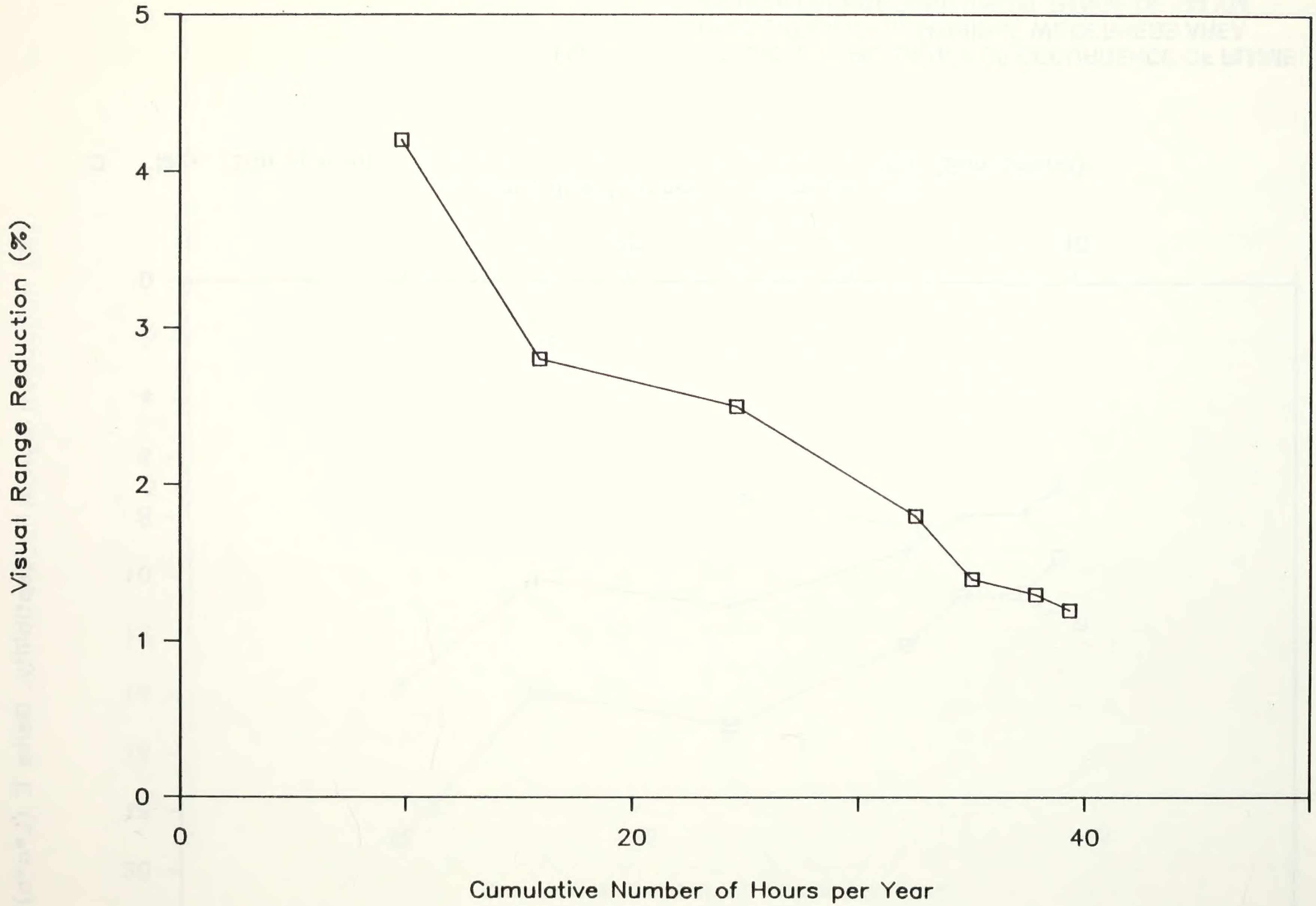


Figure 5.1-5. PREDICTED FREQUENCY OF OCCURRENCE OF VISUAL RANGE REDUCTION (%) IN JARBIDGE WILDERNESS AREA USING A BACKGROUND VISUAL RANGE OF 242 KM

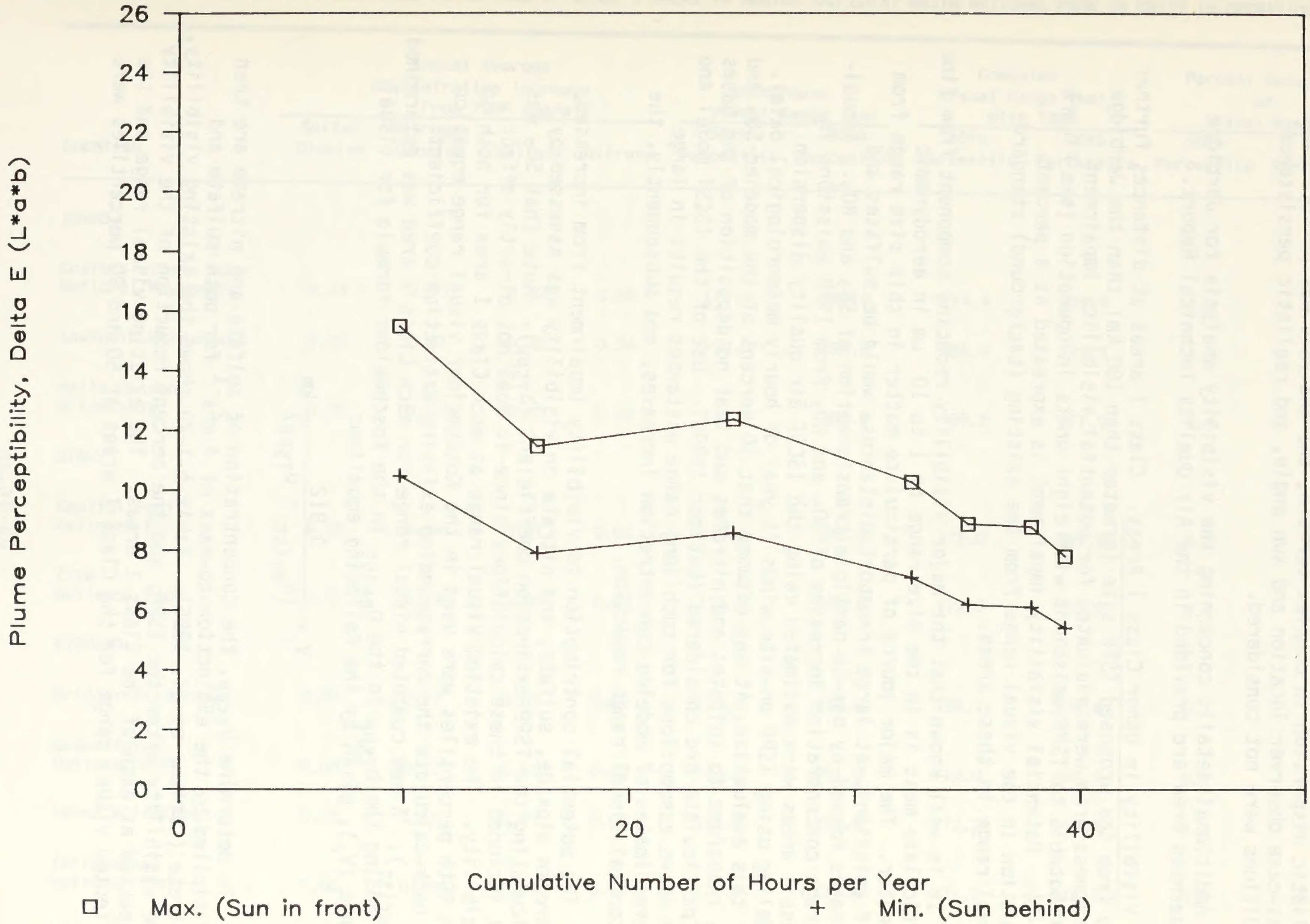


Figure 5.1-6. PREDICTED FREQUENCY OF OCCURRENCE OF PLUME PERCEPTIBILITY IN JARBIDGE WILDERNESS AREA USING A BACKGROUND VISUAL RANGE OF 242 KM

realistic dispersion in complex terrain, the analysis was performed for the worst-case observer location and sun angle, and realistic persistence conditions were not considered.

Additional details concerning the visibility analysis for Jarbidge Wilderness Area are provided in the Air Quality Technical Report.

Visibility in Other Class I Areas. Class I areas at distances further away from the proposed TSPP site (greater than 100 km) than the Jarbidge Wilderness Area were evaluated for potential visibility impairment attributable to TSPP emissions with eight units in operation (see Figure 4.1-2). Potential visibility impairment is expressed as a percent reduction in the visual range from the existing (background) standard visual range in these areas.

It is well known that the major visibility reducing component from fine particulate mass is in the size range of 1 to 10 μm in aerodynamic diameter. The major source of particulate matter in this size range from TSPP emissions, at large transport distances, would be sulfates and nitrates formed by gas-to-particle transformation of SO_2 and NO_2. Annual-average concentration increases of SO_2 and NO_2 from TSPP emissions in Class I areas were estimated using the ISCST air quality dispersion modeling using TSPP on-site winds (1 year of hourly meteorological data). For this evaluation, it was assumed that 10 percent of the modeled SO_2 and NO_2 transform to sulfates and nitrates and that no deposition of the gases or particulate are considered (Latimer 1989b). Use of the ISCST model and the above assumptions for such long range distances results in large overestimates of modeled concentration increases, and subsequently, the potential visual range reduction.

The potential contribution to visibility impairment from increased nitrogen dioxide, sulfate, and nitrate on visibility was assessed by calculating the TSPP extinction coefficient (b_{TSPP}). Note that SO_2 was not included in these calculations since it does not directly affect visibility. The existing visual range at each Class I area for both 50 and 90th percentiles were used in the Koschmeider visual range equation to back-calculate the corresponding existing extinction coefficient (b_{exist}). A new computed visual range for each Class I area was determined by adding the b_{TSPP} to the b_{exist} in the Koschmeider formula for visual range (V_r), given by the following equation:

$$V_r = \frac{3.912}{(b_{exist} + b_{TSPP})} \text{ km}$$

To determine b_{TSPP}, the concentration of sulfate and nitrate are then multiplied by the extinction-to-mass of 4 $m^2 s^{-1}$ for both sulfate and nitrate (Latimer et al. 1985). Table 5.1-20 shows the existing visibility, the visibility after the TSPP, and the percent reduction of the visibility expected at each of the Class I areas. The existing visual range and the affected visual range for the Class I areas at 50 and 90 percentiles were

Table 5.1-20. COMPUTED VISUAL RANGE REDUCTIONS AT CLASS I AREAS IN REGION AND GREAT BASIN NATIONAL PARK (8 UNITS IN OPERATION)

Location	Annual Average Concentration Increase From TSPP ($\mu g/m^3$)				Background Visual Range (km)		Computed Visual Range (km) With TSPP		Percent Reduction of Visual Range (km)	
	Sulfur Dioxide	Nitrogen Dioxide	Sulfate	Nitrate	50th Percentile	90th Percentile	50th Percentile	90th Percentile	50th Percentile	90th Percentile
IDAHO:										
Craters of the Moon National Monument	0.14	0.33	0.02	0.06	177.0	287.0	174.4	279.5	1.6	2.6
Sawtooth Wilderness	0.09	0.23	0.02	0.04	190.0	280.0	188.0	275.7	1.0	1.5
Hells Canyon Wilderness	0.05	0.12	0.01	0.02	170.0	280.0	169.2	277.9	0.5	0.8
UTAH:										
Capitol Reef National Park	0.05	0.14	0.01	0.02	179.0	258.0	178.0	255.9	0.6	0.8
Zion National Park	0.05	0.14	0.01	0.02	173.0	258.0	172.0	255.9	0.6	0.8
WYOMING:										
Bridger Wilderness	0.07	0.17	0.01	0.03	170.0	251.0	169.1	248.4	0.7	1.0
Grand Teton National Park	0.05	0.12	0.01	0.02	173.0	251.0	172.0	249.3	0.5	0.7
Teton Wilderness	0.05	0.11	0.01	0.02	173.0	251.0	172.2	249.4	0.4	0.7
Yellowstone National Park	0.06	0.15	0.01	0.03	172.0	251.0	171.2	248.7	0.6	0.9
NEVADA:										
Great Basin National Park[a]	0.07	0.17	0.01	0.03	215.0	326.0	212.8	321.7	0.9	1.3

[a] Great Basin National Park is a Class II area.

compared representing the median and maximum visual ranges (National Park Service [NPS] 1988).

All Class I areas show less than a 5-percent reduction in visual range at both the 50th and 90th percentiles as a result of operation of the proposed TSPP. Therefore, no significant visibility impacts in Class I areas beyond 100 km would occur.

Visibility Impacts in Other Areas. For the other wilderness areas of concern in the project area, a less detailed visibility analysis was performed. For these wilderness study areas, or proposed wilderness areas, the percent reduction in visual range was estimated. The same significance criterion (5 percent visual range reduction) as was applied to the Jarbidge Wilderness Area (Class I area) was used to evaluate the other wilderness areas, even though they are currently located in areas (Class II air quality areas) where air quality degradation is allowed to be greater than in Class I areas.

Visual range reduction at 50 km in each of the 16 cardinal wind directions was evaluated. Fifty km was selected since this is about the smallest distance to the nearest wilderness area of concern (see Figure 4.1-2). For each direction, potential worst-case meteorological scenarios were selected based on the joint frequency distribution of the on-site winds at 100 meters. The percent reduction in visual range was computed using background visual ranges of 144 and 242 km. The results of the visibility analysis are provided in Table 5.1-21. A projected visual range reductions from the TSPP emissions were in all cases less than the Class I Limit of Acceptable Change of 5 percent. Therefore, no significant visibility impacts are expected in the wilderness areas of concern in the project region. There would be no significant impacts to scenic vistas in the area surrounding the proposed project.

Acid Deposition. SO_2 and NO_2 emissions from the proposed TSPP may cause increased acid deposition, which could impact vegetation, soils, and aquatic systems downwind from the proposed project.

Based on past studies identifying areas with low buffering capacities (i.e., <70 μeq/L) , Emerald and Jarbidge lakes were examined for changes in pH in accordance with a screening procedure developed by the USFS (USFS 1987a). Using this procedure, annual average pollution concentrations obtained from air quality modeling were first converted to expected deposition amounts, which were then used to calculate possible lake acidity (pH) change. The equations and assumptions are provided in Section 4.5.3.2 of the Air Quality Technical Report. This method provides a worst-case estimate of pH change. Predictions can be compared to a pH change of 0.10 to determine significance. In addition, total sulfate deposition can be compared to 5 kg/ha-yr for a further indication of potentially adverse impacts on sensitive areas with low buffering capacities.

Table 5.1-21. ESTIMATED VISUAL RANGE REDUCTION AT 50 KILOMETERS FROM TSPP (EIGHT UNITS) USING AVERAGE (50TH PERCENTILE) AND 90TH PERCENTILE BACKGROUND VISUAL RANGES

Worst-Case Meteorological Conditions			Visual Range Reduction (%) Background Visual Range	
Wind Direction	Stability Class[a]	Windspeed (m/sec)	50th Percentile 144 (km)	90th Percentile 242 (km)
N	F	3	2.8	2.9
NNE	F	2	4.2	4.4
NE	F	3	2.8	2.9
ENE	F	3	2.8	2.9
E	F	2	4.2	4.4
ESE	F	2	4.2	4.4
SE	F	3	2.8	2.9
SSE	F	3	2.8	2.9
S	F	3	2.8	2.9
SSW	F	3	2.8	2.9
SW	F	3	2.8	2.9
WSW	E	2	2.5	1.9
W	F	5	1.8	1.8
WNW	E	3	1.8	1.7
NW	E	2	2.5	1.9
NNW	F	3	2.8	2.9

[a] Stability is usually expressed in terms of Pasquill-Gifford categories, ranging from Class A (very unstable) to Class F (very stable) and is a measure of the degree of atmospheric turbulence.

Table 5.1-22 provides the results of applying Forest Service screening procedures (USFS 1987a) to compute pH changes in Emerald and Jarbidge lakes and for sulfate deposition in these areas. The pH change was calculated using the total alkalinity (projected increase due to TSPP and that from the background deposition). The resulting changes in pH due to TSPP's proposed emissions (eight units in operation) at Emerald and Jarbidge lakes were 0.02 and 0.06, respectively. These projected changes are lower than the LAC for Jarbidge Wilderness of 0.1 of a pH unit. Increased contributions to sulfate deposition, above existing conditions, at Emerald and Jarbidge lakes were 0.34 and 0.35 kg/ha-yr, respectively, considerably lower than the LAC for the Class I Jarbidge Wilderness Area of 5 kg/ha-yr.

Potential increases in acid deposition resulting from the proposed TSPP in the other wilderness areas and proposed wilderness areas are listed in Table 5.1-23. All of these areas, with the exception of Jarbidge Wilderness, are in Class II regions and are currently managed as such. For Class II areas the computed deposition rates can be compared to the LACs applied to Class I areas (see Table 4.1-10). Currently, there are no LACs applied to Class II areas. The calculations were based on maximum modeled SO_2 and NO_2 concentration increases from TSPP emissions with all eight units in operation. The air quality modeling results provide conservative results since no deposition or chemical transformation of SO_2 or NO_2 were assumed during plume transport and all of the predicted SO_2 and NO_2 concentration in each area was assumed to be converted to its acidic species, respectively. For all of the areas listed in Table 5.1-23, except for the Bluebell Wilderness Study Area and the proposed East Humboldt Wilderness Area, the sulfate deposition would be less than the Class I LAC for the Jarbidge Wilderness of 5 kg/ha-yr. For Bluebell and East Humboldt depositional sulfate was projected to be 6.62 and 5.68 kg/ha-yr. In terms of total sulfur deposition, all of the areas in Table 5.1-23 had projected sulfur deposition less than the Forest Service Class I Wilderness AQRV management guidelines of 5 kg/ha-yr. Projected total depositional nitrogen for all areas in Table 5.1-23, except the proposed East Humboldt Wilderness Area, were less than the Class I Wilderness AQRV management guidelines of 5 kg/ha-yr. The projected total depositional nitrogen in the proposed East Humboldt wilderness area was 5.97 kg/ha-yr. These Class I LACs may be more restrictive than would normally be applied to a Class II area.

Based on conservative air quality modeling methodologies and USFS screening procedures, the projected deposition rates for sulfate in the Bluebell Wilderness Study Area and the proposed East Humboldt Wilderness Area would be greater than the LACs specified for the Jarbidge Wilderness Class I area. The projected total depositional nitrogen would be greater than the suggested LACs provided in the Forest Service Class I Wilderness management guidelines. If less conservative assumptions were used, the resulting computed deposition would be less than described above. The above projected deposition rates in the Bluebell Wilderness Study Area and proposed East Humboldt Wilderness Area (both Class II areas) would be considered significant impacts when the LAC criteria for Class I areas are applied.

Table 5.1-22. SUMMARY OF ANNUAL AVERAGE SO_2 AND NO_2 CONCENTRATIONS, DEPOSITION RATES, ALKALINITY, AND pH CHANGES FOR JARBIDGE LAKE AND EMERALD LAKE

	Annual Average Concentration			TSPP			BACKGROUND			TOTAL DEPOSITION (TSSP+BACKGROUND)			Alkalinity Change (µEQ/L)			pH Change		
Location	SO_2 (µg/m^3)	NO_x (µg/m^3)	PM (µg/m^3)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)	TSPP	Background	Total	TSPP	Background	Total
Jarbidge Lake	0.04	0.09	0.00	0.12	0.35	0.29	0.93	2.80	0.72	1.05	3.15	1.01	4.56	17.96	22.52	0.06	0.31	0.31
Emerald Lake	0.04	0.09	0.00	0.11	0.34	0.28	0.93	2.80	0.75	1.05	3.14	1.03	4.45	18.31	22.76	0.02	0.07	0.08

Table 5.1-23. SUMMARY OF ANNUAL AVERAGE SO_2 AND NO_2 CONCENTRATIONS AND DEPOSITIONS RATES IN JARBIDGE AND OTHER WILDERNESS AREAS OF CONCERN

	Annual Average Concentration			TSPP			BACKGROUND			TOTAL DEPOSITION (TSSP+BACKGROUND)		
Location	SO_2 ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	PM ($\mu g/m^3$)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)	Sulfur Deposition (kg/ha-yr)	Sulfate Deposition (kg/ha-yr)	Nitrogen Deposition (kg/ha-yr)
Bluebell WSA	0.70	1.80	0.06	2.21	6.62	5.68	0.37	1.10	0.29	2.57	7.72	5.97
Goshute Peak WSA	0.40	1.10	0.04	1.26	3.78	3.47	0.37	1.10	0.29	1.63	4.88	3.76
South Pequop WSA	0.40	1.00	0.03	1.26	3.78	3.15	0.37	1.10	0.29	1.63	4.88	3.44
Badlands WSA	0.30	0.80	0.03	0.95	2.84	2.52	0.37	1.10	0.29	1.31	3.94	2.81
Rough Hills WSA	0.20	0.50	0.02	0.63	1.89	1.58	0.37	1.10	0.29	1.00	2.99	1.87
E. Humboldt WA	0.60	1.40	0.05	1.89	5.68	4.42	0.37	1.10	0.29	2.26	6.78	4.71
Jarbidge WA	0.30	0.80	0.03	0.95	2.84	2.52	0.60	1.80	0.47	1.55	4.64	2.99
Jarbidge Ext. WA	0.40	1.00	0.03	1.26	3.78	3.15	0.60	1.80	0.47	1.86	5.58	3.62
Ruby Mountains WSA	0.40	1.10	0.04	1.26	3.78	3.47	0.37	1.10	0.29	1.63	4.88	3.76

WSA = Wilderness Study Area
WA = Class I Wilderness Area

In addition to evaluating the potential effects of the proposed TSPP emissions on acid deposition in the wilderness areas in the nearby region (within 100 kilometers), acid deposition Class I areas beyond 100 km were also evaluated. As stated earlier, some of these Class I (see Figure 4.1-2) areas are in the direction of the prevailing upper level winds, and therefore emissions from the proposed TSPP could potentially be transported to these areas.

To evaluate acid deposition effects, air quality modeling using conservative assumptions was performed. The EPA-approved Industrial Source Complex model was used in conjunction with meteorological data (100-meter level) collected at the proposed TSPP site. This model is not normally used to compute concentrations at such large distances from a source, but should yield a conservative result when used at these distances. In addition, during plume transport no chemical transformation or deposition was assumed. Results of this modeling for acid deposition in Class I areas are shown in Table 5.1-24. Using the LACs developed by the Forest Service for sulfate deposition, and depositional sulfur and nitrogen as significance criteria, and the fact that the modeling methodology provided overestimates of actual SO_2 and NO_2 concentrations, none of the deposition rates predicted would be significant.

<u>Secondary Growth</u>. It is expected that the towns of Elko and Wells would experience increases in population and vehicular activity due to construction and operation of the proposed TSPP. The two communities would experience a project population increase of about 2038, at peak workforce in the year 2000. In turn, this would produce the need for 827 homes, of which it is estimated that 537 new homes would be built. This is a worst-case analysis which assumes no construction-worker camp and the Moor Summit alternative access road.

The air quality impacts of a population increase in the Elko and Wells area would be primarily due to initial home development, residential space heating, and vehicular exhaust. To estimate potential dust emissions from new home construction, fugitive PM emission factors from EPA's AP-42 document (EPA 1985a) were used. For the analysis of residential space heating, the assumed breakdown of energy sources was 35-percent electric, 30-percent wood-burning, and 35-percent propane fuel, and again, EPA AP-42 emission factors were used to calculate potential emissions. Table 5.1-25 gives estimated emissions from new home construction and residential space heating, along with predicted ambient air pollutant concentrations associated with these emissions. The table shows that estimated emissions and contributions to ambient air concentrations are insignificant in comparison with emissions from the proposed TSPP (see Table 5.1-4) and EPA significance levels for air quality impacts (see Table 4.1-1).

In order to estimate air quality impacts from vehicular exhaust, projections of future traffic were combined with estimates of project-related vehicle volumes on roadways that would be most affected (Section

Table 5.1-24. PREDICTED MAXIMUM INCREASE IN ANNUAL AVERAGE SO_2 AND NO_2 CONCENTRATIONS, AND SULFUR AND NITROGEN DEPOSITION IN REGIONAL CLASS I AREAS AND GREAT BASIN NATIONAL PARK FROM TSPP EMISSIONS (AT FULL BUILDOUT)

Receptors	Annual[a] SO_2 Conc. ($\mu g/m^3$)	Annual[a] NO_2 Conc. ($\mu g/m^3$)	Sulfur[b] Deposition (kg/ha/yr)	Sulfate[c] Deposition (kg/ha/yr)	Nitrogen[d] Deposition (kg/ha/yr)
IDAHO:					
Craters of the Moon National Monument	0.15	0.37	0.47	1.41	0.70
Sawtooth Wilderness	0.10	0.26	0.32	0.97	0.48
Hells Canyon Wilderness	0.05	0.13	0.16	0.48	0.24
UTAH:					
Capitol Reef National Park	0.06	0.15	0.19	0.58	0.29
Zion National Park	0.06	0.15	0.19	0.56	0.28
WYOMING:					
Bridger Wilderness	0.08	0.19	0.24	0.72	0.36
Grand Teton National Park	0.05	0.13	0.16	0.49	0.24
Teton Wilderness	0.05	0.12	0.15	0.44	0.22
Yellowstone National Park	0.07	0.17	0.21	0.63	0.32
NEVADA:					
Great Basin National Park[e]	0.08	0.19	0.24	0.73	0.37

[a] Concentration assumes no deposition or chemical conversion.
[b] Deposition values computed assuming all SO_2 converted to sulfur.
[c] Deposition values computed assuming all SO_2 converted to sulfate.
[d] Deposition values computed assuming all NO_2 converted to nitrogen.
[e] Great Basin National Park is a Class II area.

Table 5.1-25. PROJECTED AMBIENT AIR IMPACTS FROM CONSTRUCTION AND RESIDENTIAL HEATING ASSOCIATED WITH SECONDARY GROWTH

Pollutant	Emission Rates (Tons/Year) Space Heating: Propane	Wood	Housing Construction	Total	Predicted Annual Concentration[a] ($\mu g/m^3$)
Elko					
Particulates	0.1	28.1	259	287.2	0.83
Sulfur Dioxide	--	0.3		0.3	0.00
Carbon Monoxide	0.38	55.4		55.8	0.16
Oxides of Nitrogen	1.8	1.4		3.2	0.01
Wells					
Particulates	--	7.6	84.6	82.2	0.24
Sulfur Dioxide	--	--		--	--
Carbon Monoxide	0.1	15.2		15.3	0.04
Oxides of Nitrogen	0.5	0.4		0.9	0.00

[a] Contribution from construction and residential heating (i.e., above existing background concentrations).

5.13.1.2). Maximum traffic volumes are predicted for the year 2000 due to the overlap between construction and operation workforces. Worst-case CO and NO_2 emissions were modeled for a 1-hour peak traffic period using the no construction-worker camp alternative, with the location of maximum impact being the intersection of Highway 93 and 6th Street in Wells through which a major portion of the traffic traveling to the plant would pass. This estimate is conservative because workers residing in Twin Falls or Jackpot (with the proposed access and Brush Creek Alternative) and Wendover (with the Moor Summit Alternative) would not pass through this intersection. Mobile emission concentrations were computed using the CALINE4 dispersion model (California Department of Transportation 1984). Table 5.1-26 depicts the calculated worst-case vehicular impacts from secondary growth, and shows them to be well within applicable ambient air quality standards.

The analysis of traffic emissions took into account existing and non-project-related truck traffic, with increases projected for future years. The addition of project-related truck traffic (i.e., trucks transporting equipment and building materials to the site) would not affect the conclusions of this analysis. Project truck traffic is estimated to be at 10 to 15 trucks per day, or 1 or 2 per hour, which would be a negligible change to the peak 1-hour volumes modeled.

<u>Other Nevada Air Quality Permitting Requirements</u>.

<u>Criteria Air Pollutants</u>. The proposed project is required to install BACT to fulfill PSD requirements. The levels of air pollution control currently proposed as BACT for the proposed TSPP project would meet the "criteria" air pollutant emission limitations contained in the Nevada Administrative Code (NAC).

<u>Air Toxics</u>. The NAC specifies criteria for evaluating emissions of "toxic" air pollutants. For this analysis, it was assumed that the main source of toxic or hazardous air contaminants would be the power plant stacks. Potential emissions of chloroform from the cooling towers as a result of chlorination of the cooling tower water were also considered. Other air emission sources at the proposed TSPP were considered minor emitters of potential air toxics and not evaluated.

Potential toxic or hazardous air contaminants emitted from the power plant stacks were identified from the coal trace element analyses and from a review of literature. These contaminants were categorized as either trace elements, organic pollutants, or radionuclides. For the first category, trace elements, only those with threshold limit values (TLVs) were considered to be toxic or hazardous air contaminants. For the second category, organic pollutants, formaldehyde, and polycyclic organic matter (POM) were identified as potential toxic or hazardous contaminants based on a review of the literature (Lokey and Manning 1988; Shih et al. 1980; Radian 1989). Several POM compounds are either confirmed or suspected carcinogens; therefore, one of these compounds, benzo(a)pyrene (B[a]P), was selected as the surrogate POM for the purposes of this analysis. This is a

Table 5.1-26. WORST-CASE AMBIENT CONCENTRATIONS AT WELLS INTERSECTION FROM MOBILE SOURCES RELATED TO SECONDARY GROWTH

Pollutant	Averaging Time	Background ($\mu g/m^3$)	Impact ($\mu g/m^3$)	Total ($\mu g/m^3$)	National Standard ($\mu g/m^3$)	Nevada Standard ($\mu g/m^3$)
Carbon Monoxide	1-Hour	1,142[a]	1,600	2,742	40,000	40,000
Carbon Monoxide	8-Hour	1,142[a]	1,280	2,422	10,000	6,670[b]
Oxides of Nitrogen	Annual	1.9	7.5	9.4	100	100

[a] Source: Johnson (1989)

[b] Standard applies at elevations greater than 5000 feet MSL.

health-conservative assumption since B(a)P is one of the more toxic POMs. A TLV is not available for B(a)P, thus estimated cancer risks from exposure to B(a)P were assessed at the request of the Air Quality Officer of the NDEP. Finally, for the third category of potential toxic or hazardous air contaminants, radionuclides, emissions of such compounds from coal combustion are small and the resulting cancer risks are quite low compared to natural background dosages (Lokey and Manning 1988). Thus, radionuclide emissions were not considered.

In addition to the power plant stack emissions, potential emissions of chloroform from the cooling towers were evaluated. As discussed earlier, up to 2 percent of the added chlorine in a cooling tower may be converted to trihalomethane compounds, and chloroform would constitute approximately half of these trihalomethanes. As a health-conservative assumption, it can be assumed that all these potential trihalomethanes could be converted to chloroform and emitted to the atmosphere.

Air quality dispersion modeling was performed to evaluate whether emissions of toxic or hazardous air contaminants from the proposed TSPP project would exceed acceptable concentrations for the quality of ambient air (ACQAAs), computed per NAC requirements. Annual and maximum 8-hour-average ground-level concentrations were calculated assuming uncontrolled emissions (as required by the NDEP) from the plant (eight units operating). Barium, beryllium, and vanadium were the only toxic or hazardous air contaminants that exceeded their ACQAAs.

Section 445.719 of the NAC requires BACT for toxic or hazardous air contaminants that, without controls, would emit more than 0.25 pounds of contaminant per 8-hour shift and exceed applicable ACQAA. The currently proposed TSPP air pollution control system for sulfur dioxide and particulate matter is a lime spray dryer scrubber and baghouse system. This control technology combination has been conservatively estimated to control beryllium emissions by 99 percent (EPA 1989b), and should be able to control barium and vanadium emissions by the same degree. With this level of control, proposed as BACT for barium, beryllium, and vanadium, modeled concentrations for these elements are far below their ACQAAs.

As discussed above, B(a)P does not have a TLV that can be used to compute an ACQAA. For B(a)P, the EPA has derived a constant to estimate its strength as a cancer-causing agent. This constant, the unit risk factor, describes the relationship between inhalation exposure and cancer risk. The cancer risk from exposure to B(a)P is calculated as the product of the unit risk factor and the modeled annual average ground-level concentration. For the proposed TSPP, the resultant estimated cancer risk from B(a)P was computed to be 4.3×10^{-7}, that is, a 4.3 chance in 10 million. This cancer risk is well below the commonly used value of 1.0×10^{-6} (one in a million) as an indicator of significant risk (California Air Pollution Control Officers Association [CAPCOA] 1987).

Global Warming ("Greenhouse Effect").

Section 4.1.3.4 discussed the relationship between atmospheric releases of heat-trappping gases and possible increases in future global temperature, i.e., the so-called "greenhouse effect." These gases include carbon dioxide (CO_2), methane, chlorofluorocarbons, nitrous oxide, tropospheric (lower atmosphere) ozone, and several other trace gases (EPRI 1988). Greenhouse gas sources (Marland and Rotty 1985; EPRI 1988) can be anthropogenic, natural, or both. Of these gases, CO_2 is thought to have the largest contribution (49 percent) to global warming, and comprises by far the most significant portion of the proposed TSPP's gaseous emissions.

Estimates of the contribution from the U.S. to total global CO_2 emissions due to fossil fuel combustion range from 20 to over 25 percent. Of the total U.S. CO_2 emissions, 30 to 35 percent comes from fossil-fuel-fired electric power plants, about 20 to 30 percent from transportation, 20 to 25 percent from industrial/commercial sources, and 10 to 15 percent from the residential sector (EPRI 1988b; OTA 1988; Machado and Piltz 1988).

The proposed TSPP project is estimated to emit about 2.1 million tons/yr of CO_2 from each 250-MW unit, or about 17.2 million tons/yr of CO_2 (4.3 million metric tons/yr of carbon) when all eight units become operational. This represents approximately a 0.1 percent increase in the total global CO_2 emissions from fossil fuel combustion and about 0.4 percent of the total U.S. CO_2 emissions from fossil fuel combustion. Owing to the large uncertainties in predicting future local and global concentrations of CO_2 and their effect on climate, ascertaining the effect of an increase in global CO_2 emissions of 0.1 percent is not possible with today's technology (models). For example, since the current models predict that a 100-percent increase (a doubling) in CO_2 emissions would result in a mean global temperature increase of 2 to 5°C (Stone et al. 1988), a linear extrapolation to a 0.05-percent increase (assuming 50 percent of the 0.1-percent increase remains airborne) results in a predicted mean global temperature increase of 0.001 to 0.0025°C. Since climatic effects of CO_2 are probably nonlinear and region specific, the calculated temperature increase is even more uncertain. This estimated temperature increase is within the uncertainties in model parameters and inherent randomness of the environment.

Currently, there are no feasible technologies to control CO_2 emissions from fossil fuel combustion. The most promising CO_2 emission control technology is CO_2 scrubbing. This technology has not been demonstrated at a scale comparable to a power plant. In addition, it would require about 6 percent of the plant's generation capacity to operate and disposal of the collected CO_2 would pose considerable problems (OTA 1988). If CO_2 removal technologies prove feasible in the future, they could be required for the project's generation units as each unit is proposed for construction and operation.

As of December 1989, no proposed new modifications to the Clean Air Act or global climate change law(s) were being considered by Congress that

would affect CO_2 emissions from this project. However, reasonable facsimiles of tabled laws may be re-introduced during future congressional sessions. Although President Bush's proposed modifications to the Clean Air Act did not address CO_2 emission limitations, there were other proposed laws that did seek to limit CO_2 emissions. The 1989 Congress considered laws such as S324, which would have established a national goal of reducing CO_2 emissions by 20 percent by the year 2000; S2663, which would reduce CO_2 emissions by 50 percent by the year 2040; and S2666, which recommended switching to low-CO_2 producing technologies. The implementation of these laws is unclear at the present time, and therefore, it is unknown if TSPP would be impacted. The phased nature of TSPP would allow maximum flexibility in addressing future regulatory changes, since each generation unit would be subject to the regulatory requirements in place at the time the units are proposed for construction and operation.

In addition to controlling individual sources, other measures have been suggested for reducing atmospheric CO_2 levels. Increasing CO_2 fixation can be achieved through methods ranging from fertilizing ocean plankton or freshwater algae, to planting large expanses of new forest. Conservation activities aimed at halting deforestation and forest degradation can also provide some degree of protection for existing forests, thus preventing the release of already fixed, sequestered carbon to the atmosphere. Increasing agricultural activity and productivity, and minimizing the burning of agricultural fields can promote CO_2 fixation and reduce its release.

5.1.2 ALTERNATIVES

5.1.2.1 Alternative Access Roads

Moor Summit Access Road. The secondary growth air quality analysis presented in Section 5.1.1.2 gave results of highway air quality modeling under worst-case conditions, that is, all vehicular traffic from worker commutes (under the no construction-worker camp alternative) were assumed to pass through the intersection of Highway 93 and 6th Street in Wells. This worst-case analysis yielded insignificant air quality impacts, thus the Moor Summit Access Road Alternative would not result in any significant air quality impacts.

Brush Creek Access Road. As stated above, worst-case highway air quality modeling, that is, assuming all vehicular traffic from worker commutes (under the no construction-worker camp alternative) would pass through the intersection of Highway 93 and 6th Street in Wells, yielded insignificant air quality impacts. Thus, the Brush Creek Access Road Alternative would not result in any significant air quality impacts.

5.1.2.2 No Construction-Worker Camp Alternative

The no construction-worker camp alternative represents the worst-case impact in secondary growth emissions due to the construction and heating of new residences in Wells and Elko, and increased vehicular emissions due to worker commutes to the TSPP site. This scenario was evaluated in the secondary growth analysis presented in Section 5.1.1.2, and that analysis

found insignificant air quality impacts. Thus, the worker accommodations in both the proposed action (construction-worker camp) and this alternative (no construction-worker camp) would not cause any significant air quality impacts.

5.1.3 MITIGATION

The purpose of this section is to describe suggested measures for the mitigation of potentially significant air quality impacts from construction and operation of the proposed project and alternatives.

5.1.3.1 Construction Impacts

Impacts due to dust generated by excavation and construction activities would be localized and of a temporary nature, and would not have a significant impact on long-term local or regional air quality. There could be, however, significant short-term ambient concentrations in the vicinity of construction activities. It is recommended that dust control practices be employed to minimize these potential short-term impacts. Such practices include, but are not necessarily limited to, general watering in active excavation and grading areas, use of watering or chemical stabilizers on completed cuts and fills and on temporary construction roads, and revegetation of disturbed areas.

5.1.3.2 Operational Impacts

As part of the air quality permitting process (i.e., PSD permitting) that will follow the NEPA review, specific requirements for meteorological, air quality, and related environmental monitoring will be stipulated to assure compliance with the air quality permit conditions. Table 5.1-27 shows potential meteorological and air quality monitoring for TSPP, based on impacts associated with TSPP, and requirements stipulated by air quality regulatory agencies for other power plants.

The following mitigation measures are recommended to reduce project-related air quality impacts:

- Minimize exhaust emissions from private vehicles of construction and operation workers by bussing workers to and from the project site.

- It is recognized that TSPP would be a major source of sulfur dioxide, nitrogen oxide, and to a lesser extent, other air contaminants. Concentrations of air pollutants are projected to exceed the short-term (3- and 24-hour average) PSD increments. It is apparent, however, that all eight units of the proposed TSPP, if constructed as planned, could have the potential for adverse impacts to regional air quality.

  To ensure that these potential impacts are either not realized or are mitigated by adding more efficient air pollution control technology, an air resources coordination group should be

Table 5.1-27. POTENTIAL METEOROLOGICAL AND AIR QUALITY MONITORING FOR THE PROPOSED TSPP

Concern	Parameters To Be Monitored	Location of Monitoring
Compliance with Federal and State air quality requirements	Meteorology and criteria pollutants	Location of predicted maximum concentration
New source performance standards	Sulfur dioxide, nitrogen oxides, and opacity	Stack
Air Quality Related Values (AQRVs)	Visibility (fine particulates and visual range), acid deposition (pH and chemical speciation of rainfall), and indicator lichens (metals and sulfur)	Wilderness Areas[a]

[a] Monitoring of AQRVs is already being conducted at Jarbidge Wilderness Area.

formed. This group should consist of representatives from the Bureau of Land Management, U.S. Forest Service, U.S. Fish and Wildlife Service, Nevada Division of Environmental Protection, National Park Service, and Thousand Springs Generating Company. Their primary functions would be to provide technical information to the Nevada Division of Environmental Protection as it makes decisions concerning best available control technology on each of the eight generating units as they are individually permitted.

This information would primarily be gathered through a regional program which would address the following:

- Visibility, deposition, and particulate matter (less than 10 microns) monitoring programs in areas such as the Jarbidge Wilderness Area, East Humboldt Wilderness Area, Badlands Wilderness Study Area, Bluebell Wilderness Study Area, and others. Particular focus should take into account potential impacts to air quality related values in Class I areas.

- The U.S. Forest Service should be assisted in their air quality related values monitoring in Jarbidge Wilderness, as appropriate.

- Comparison of the above-described monitoring data with information gathered at existing National Atmospheric Deposition Program/National Treads Network, National Dry Deposition Network, and Interagency Monitoring of Protected Visual Environments monitoring sites on a continuous basis and to allow the Nevada Division of Environmental Protection to decide on control technologies for units as prior to construction or whether air pollution impacts had reached a level where no more units could be built.

- To date, the applicant has not applied for their Prevention of Significant Deterioration Permit. Therefore, the State of Nevada Department of Conservation and Natural Resources, Division of Environmental Protection has not made a determination as to the best available control technology nor the emission limits that would be appropriate and required for this proposed facility to be in compliance with Federal and state PSD regulations. Therefore, the Bureau of Land Management could consummate the land exchange contingent upon Thousand Springs Generating Company meeting Nevada air quality permit conditions, PSD requirements, and providing continuous emissions monitoring during the operation of each unit to ensure the project is in compliance with all appropriate regulations.

5.2 NOISE

5.2.1 PROPOSED ACTION

Assumptions relative to plant design and noise source emissions were made in order to assess potential noise levels associated with the construction and operation of TSPP. The following sections provide descriptions of calculated sound levels. Descriptions of assumed vehicular and train traffic and predictions of the associated sound levels are also provided. The assumed equipment noise source emissions are provided in the Noise Technical Report.

5.2.1.1 Construction Noise Levels

Noise generated from construction of the power plant would increase noise levels above existing conditions. Computed noise source emissions for equipment expected to be used in site preparation and construction activities, and combined plant, railroad, and access road predicted noise levels during site preparation and excavation construction phases are given in the Noise Technical Report. Noise impacts were evaluated at selected sensitive receptor locations (Winecup Ranch, Black Mountain, Cobre, Toano, and Montello) and at other locations surveyed during the noise study (see Section 4.2.4).

The maximum 1-hour sound levels for the Winecup Ranch would be dependent on the location and proximity of the road construction. The largest 1-hour sound level increase for a sensitive receptor would be experienced at the Winecup Ranch, where 1-hour noise levels could increase from an existing 33 A-weighted decibel level (dBA) up to 61 dBA, a change of 28 dBA, and day-night levels (L_{dn}) would increase 18 to 57 dBA, a change of 39 dBA. This temporary significant change in noise levels would occur during construction of the access road, and would decrease following completion of road construction. Sound levels for the Valley Pass and Toano areas would be dependent on the proximity of the railroad construction. The highest 1-hour sound level at a sensitive receptor is estimated to be 63 dBA at Cobre. While the highest L_{dn} at the same location is estimated to be 69 dBA, this noise level is the same as the background or measured noise at Cobre, and therefore, project construction would have no detectable impact on existing noise levels at Cobre. All maximum construction noise levels are within the U.S. Department of Housing and Urban Development's (HUD's) suggested "Normally Acceptable" category and below the 67 dBA Federal Highway Administration (FHWA) criterion. (See Section 4.2 for a description of the criterion. Winecup Ranch and Cobre would be above the suggested EPA 55 dBA criterion for outdoor residential areas.)

5.2.1.2 Operational Noise Levels

The proposed operation of TSPP would result in an increase of noise surrounding the plant. Radiated noise levels were calculated by assuming that the total sound emitted by the plant is radiated hemispherically from a point approximating at the plant center. Total sound emitted was calculated by estimating the sound pressure level at each major plant surface, calculating the corresponding radiated sound power from each surface, and summing the results. The calculations and equations used are presented in the Noise Technical Report.

Maximum 1-hour steady-state noise levels from TSPP were computed at sensitive receptor locations and at most of the locations surveyed in the baseline noise study described in Section 4.2.4. The results of these calculations are shown in Table 5.2-1.

The calculated noise levels for Cobre and Montello showed no increase due to projected noise levels emanating from the proposed power plant. Winecup Ranch would experience a calculated increase from a 1-hour maximum background level of 33 to 41 dBA and a L_{dn} increase from 39 to 47 dBA. The Black Mountain area would experience a calculated increase from a background level of approximately 22 to 40 dBA and a L_{dn} increase from 28 to 46 dBA. Likewise, calculations for the Toano area show an increase from a 1-hour background level of 35 to 38 dBA and a L_{dn} increase from 41 to 44 dBA. These new noise levels are within the suggested HUD acceptable criteria level (Table 4.2-3) and are below the suggested Federal Highway Administration (FHWA) Noise Abatement Criterion of 67-dBA for Activity Category "B" (Table 4.2-2) and are below the suggested EPA 55 dBA L_{dn} criterion.

The predicted maximum steady-state and intermittent sound levels due to the operation of all eight units at 16 points along the plant boundary (fenceline) are shown in Table 5.2-2. Figure 5.2-1 shows the positions of these 16 plant boundary locations. The predicted maximum 1-hour sound level varies from 58 to 71 dBA. Predicted noise levels at PB1, the plant boundary corner near the construction craft check station and construction change house, is the noisiest at 71 dBA.

The maximum predicted "intermittent" sound levels along the plant perimeter (fenceline) were predicted at several points. This intermittent noise would result from a corona associated with the transmission line in wet weather and occasionally from the tripping of circuit breakers. Maximum predicted intermittent levels of 93 dBA were predicted. This maximum level is expected to occur for only short periods of time, and therefore should not exceed OSHA significance levels.

Predictions of the maximum 1-hour and intermittent sound levels experienced by workers at the construction parking lot (PB2) and at the construction-worker camp (PB15 and PB16) were made assuming seven units in operation. This is a worst-case analysis because, by the time the eighth unit became operable, the construction-worker camp would have been

Table 5.2-1. PREDICTED MAXIMUM OPERATIONAL NOISE LEVELS (dBA) AT SELECTED RECEIVER LOCATIONS FROM THE THOUSAND SPRINGS POWER PLANT (2000 MEGAWATTS)

Receiver Location Section/Township/Range	Site No.	Distance to Plant Center (miles)	Existing Maximum Hour Sound Level (dBA)[a]	Predicted Maximum Hour Sound Level (dBA)[a]	Predicted Maximum Intermittent Sound Level (dBA)[a]
Montello[b] 17/39N/69E	S1	18.7	57	57	57
Loray Wash 29/38N/68E	S3	17.8	71	71	71
Winecup Ranch[b] 25/41N/64E	S4	8.5	33	41	54
Fivemile Well, 2½ mi S 14/40N/66E	S6	3.2	25	49	63
Twentyone Mile Draw 32/41N/67E	S7	7.7	26	41	55
Thurston Spring, 2 mi E 05/65E/39N	S8	6.6	22	42	56
Valley Pass 14/38N/66E	S9	11.7	69	69	69
Cobre 400 ft from Railroad[b] 04/37N/67E	c	17.1	63	63	63
Toano Mile from Railroad[b] 29/38N/67E	c	14.5	35	38	50
Black Mountain[b] 35/40N/64E	d	9.0	22	40	54

a re: 20 μN/m²

b Sensitive Receptor

c No noise measurements were taken in Cobre or Toano. Projected noise levels were estimated from the distance the railroad tracks are from the receiver location and a background noise level of 33 dBA.

d No noise measurements were taken at Black Mountain. Projected noise levels were considered to be approximately equivalent to Thurston Spring.

Table 5.2-2. PREDICTED MAXIMUM OPERATIONAL NOISE LEVELS (dBA) AT PLANT BOUNDARY LOCATIONS AT THE THOUSAND SPRINGS POWER PLANT (2000 MW)

Plant Boundary Location[a]	Existing Maximum Hour Sound Level (dBA)[b]	Predicted Maximum Hour Sound Level (dBA)[b]	Predicted Maximum Intermittent Sound Level (dBA)[b]
PB1	33	71	86
PB2[c]	33	70	79
PB3	33	67	76
PB4	33	60	73
PB5	33	62	74
PB6	33	58	71
PB7	33	68	77
PB8	33	59	74
PB9	33	59	75
PB10	33	59	76
PB11	33	68	93
PB12	33	68	93
PB13	33	59	76
PB14	33	58	73
PB15[c]	33	67	80
PB16[c]	33	69	88

[a] Refer to Figure 5.2-1.

[b] re: 20 $\mu N/m^2$

[c] Predicted sound levels are the same for seven units operating except at PB2. PB2 will have a predicted maximum hour sound level of 69 dBA.

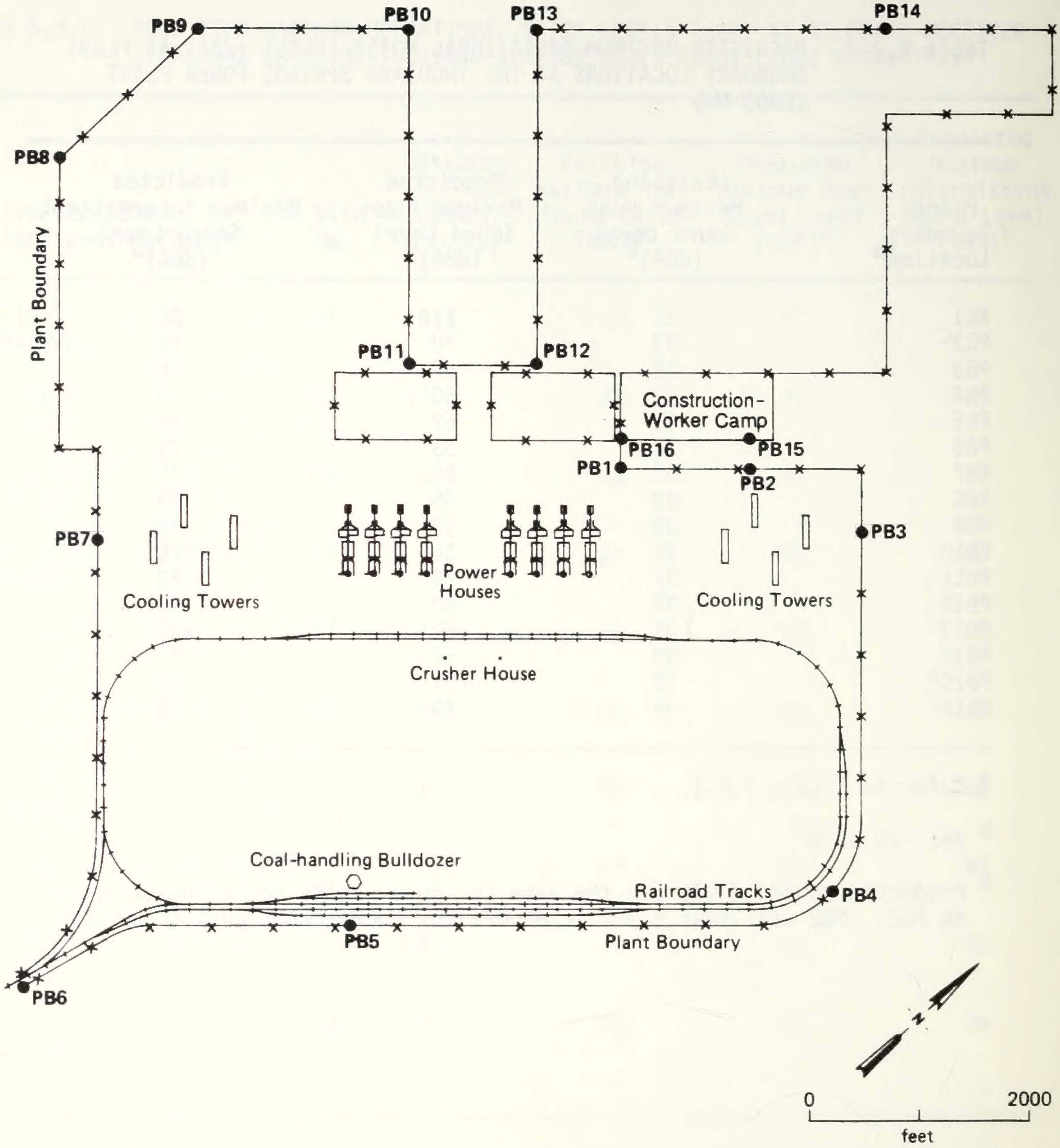


Figure 5.2-1. RECEPTOR POINTS ALONG THE PROPERTY BOUNDARY (PB1 THROUGH PB16) AND MAJOR NOISE SOURCES AT THOUSAND SPRINGS POWER PLANT

removed. The noise levels experienced in the construction-worker camp at PB16 were above the suggested FHWA Noise Abatement Criterion of 67 dBA by 2 dBA. Both construction-worker camp points (PB15 and PB16) were within the suggested HUD "Normally Unacceptable" category and are above the suggested EPA 55 dBA L_{dn} criterion.

5.2.1.3 Vehicular Traffic Noise Levels

The proposed action would result in increased traffic along U.S. 93, Interstate 80, and county roads. The proposed access road also would create a new traffic noise source along its route. Traffic volumes and distribution associated with the proposed project were used to model peak 1-hour and maximum L_{dn} traffic noise levels. Three different traffic scenarios were evaluated for the proposed action, with the peak traffic conditions occurring during the maximum combined construction and operation workforce period (in the year 2000). The estimated change in noise levels as a result of increased traffic and the peak 1-hour traffic noise level were predicted at 250 feet from the roadways.

With the proposed construction-worker camp, the maximum 1-hour noise increase associated with peak-hour traffic is estimated to be 2 dBA along Interstate 80 and 4 dBA along State Route 93. The L_{dn} increase due to all the proposed routes is less than 1 dBA. A change in noise levels of 2 to 3 dBA is barely detectable to the human ear, and changes below 5 dBA are generally considered acceptable (FHWA 1982); therefore, the predicted increases in traffic due to the proposed project would not result in significant noise impacts.

The peak-hour traffic noise levels along the proposed Wilkins access road would be highest at Winecup Ranch with a predicted peak-hour noise level of 47 dBA. This maximum noise level would occur during the morning and afternoon periods when workers would be driving to and from the job site. During the remainder of the day, periodic truck traffic (estimated at 10 to 15 trucks/day) would result in intermittent noise. All 1-hour peak noise levels for all sensitive receptors are below the FHWA Noise Abatement Criterion of 67 dBA and below the suggested EPA 55 dBA L_{dn} criterion. This impact is not considered significant.

5.2.1.4 Train Noise Levels

The projected increase of train traffic (four to five 55-car trains per day) as a result of the proposed project would not augment background noise levels significantly at sensitive receptors near railroad tracks. The increases in train noise at all receptors would be less than a decibel in terms of a 24-hour L_{dn}. Noise levels for the new trains were estimated from measurements taken on April 13, 1989.

5.2.1.5 Noise Effect on Wildlife

Noise generated from the construction of the power plant, railroad, and access road would increase noise levels above existing conditions. Noise generated by construction equipment would be short-term and intermittent. The calculated increase in construction noise levels is below levels of

concern, although the amount of disturbance to wildlife is dependent on the sensitivity of a particular species (Moore and Mills 1977). Big-game mammals, raptors, and breeding birds would most likely avoid areas under construction, thereby effectively reducing the amount of habitat available for wildlife. Some displaced animals would not survive if adjacent habitat was already at carrying capacity. The low shrub vegetation surrounding the construction areas would not act as a good visual or sound barrier. Nonetheless, all projected noise levels are below levels of concern and, therefore, no significant noise-related impacts to wildlife are expected.

Noise impacts to wildlife resulting from the operation of the proposed plant would be similar to those projected for power plant construction. The predicted maximum hour sound levels around the TSPP boundary indicate a decibel level of 58 to 68. The noise levels further from the plant boundary are expected to be lower. Comparatively, the operational noise levels would be lower and more constant than the noise created by construction activities. The constant noise would allow animals to acclimate to increased decibel levels. Most mobile animals would disperse into other areas until the noise level fell below an acceptable background level (Moore and Mills 1977). Mammals and birds that do emigrate to other areas would encounter increased competition for resources. Some displaced animals could be lost if adjacent habitat was already at carrying capacity.

5.2.2 ALTERNATIVES

5.2.2.1 Alternative Access Roads

Construction of the Brush Creek access road would result in the same temporary, significant noise increases as anticipated for the proposed action (i.e., Wilkins access road). At one sensitive receptor, Winecup Ranch, the maximum 1-hour noise level during construction of this road would be 68 dBA, in comparison to 61 dBA for the proposed action and the 24-hour L_{dn} would be 64 dBA, in comparison to 57 dBA. At all other receptors, road construction noise levels would be the same.

During the peak construction operation year (2000), traffic noise from the Brush Creek road is predicted at 53 dBA at Winecup Ranch, in comparison to 47 dBA for the proposed action. This impact is still below the FHWA Noise Abatement Criterion of 67 dBA and the EPA 55 dBA L_{dn} criterion and, therefore, is not considered significant.

Construction of the Moor Summit access road would reduce the construction noise levels at Winecup Ranch from 61 dBA (with the Wilkins road) and 68 dBA (with the Brush Creek road) to 47 dBA. Construction noise levels at all other sensitive receptors would be the same as for the proposed action. Maximum noise levels for construction and operation traffic using the Moor Summit road would be below the FHWA Noise Abatement Criterion of 67 dBA and below the suggested EPA 55 dBA L_{dn} criterion and, therefore, are not significant.

5.2.2.2 Alternative Construction-Worker Accommodation

The no construction-worker camp alternative would avoid the impact of locating worker residential facilities in an area near the plant which may exceed suggested significant noise criteria levels. Construction workers would instead reside in local communities, which would result in slightly increased traffic noise levels on I-80, State Route 93, and the access road. However, the noise increases under this alternative would be less than 2 dBA and are not significant.

5.2.3 MITIGATION

5.2.3.1 Proposed Action

Mitigation measures are recommended when the first unit is operating, when the noise level at the construction-worker camp would be above 55 dBA L_{dn}. To mitigate the noise exposure to construction workers at the camp, noise reduction measures should be considered in the final design plans. Soundproofing of the residence buildings, through installation of insulation or other attenuation means, should be used to reduce noise to acceptable levels. Alternative mitigation measures would be to construct a noise barrier (e.g., a wall and/or an earthen berm) between key areas of the construction-worker camp and the power plant, to increase the shielding around noise sources within the plant, or to relocate the construction-worker camp outside the area where project-related noise levels would exceed Federal or state standards.

To minimize the temporary significant increase in noise at the Winecup Ranch headquarters area due to construction of the access road, construction activities in the vicinity of residences or other sensitive land uses should be scheduled to occur during daytime hours. Construction-equipment noise-control measures, including the use of mufflers, derating engines, sealing and lubricating tracks on bulldozers, isolating engine vibration, turbocharging, and adhering to a regular maintenance schedule, also should be considered as mitigation.

Noise monitoring during construction is recommended to determine if the OSHA standard of 88.4 dBA for a 10-hour day is exceeded.

5.2.3.2 Alternatives

Noise monitoring during construction is recommended to determine if the OSHA standard of 88.4 dBA for a 10-hour day is exceeded.

5.3 GEOLOGIC CONSIDERATIONS

5.3.1 PROPOSED ACTION

5.3.1.1 Land Acquisition

Due to the locatable mineral potential on a portion of the offered lands, impacts could occur to the BLM's ability to manage those lands. Mining of these locatable mineral resources could significantly reduce these lands' value for recreation potential, wildlife habitat, and

grazing. Future mineral development would be subject to surface reclamation procedures under Assembly Bill 958, the Nevada Mining Reclamation Law.

5.3.1.2 Construction

An earthquake could induce hazards affecting the construction of the proposed power plant. The probability of an earthquake occurring is difficult to assess because of the possible presence of unknown faults, the uncertainty of the interval between earthquakes, and the unknown ages of the last rupture on faults within the basin. However, because the interval between earthquakes in the region ranges from several hundred to several thousand years (Wallace 1984), the probability of an earthquake greater than magnitude 3 occurring during construction would be very low.

The possibility of liquefaction occurring at the proposed power plant site depends on the presence of liquefiable materials. The probability that rockfalls, landslides, and debris flows would impact the project depends on several factors: the probability of an earthquake which may cause instability of slopes, the relative physiographic relief within the vicinity of the plant site, and storm events that may induce instability. Because the proposed power plant site is located in an area of relatively low relief and away from steep mountain slopes, it is unlikely that the site would be subjected to these phenomena.

Periods of high intensity or prolonged rainfall may result in flooding in low areas and along alluvial fan channels. Toano Draw, which runs in a northwest-southeast direction a few miles west of the proposed plant site, could present a risk of flooding to the power plant and the access road, under conditions of a maximum credible flood event (100-year event). These conditions could occur, for example, if a major, warm rainstorm were to occur during the spring melting of the snowpack.

Hydrocompaction and subsidence are a function of structures within soil, particularly clay, and could occur with the addition or removal of groundwater. Withdrawal of groundwater is not expected to result in any significant subsidence. If subsidence or settlement occurs, it should be minor, and is expected to be uniform across the plant site, thus minimizing potential flexing and deformation of the plant foundation and secondary structures. However, geotechnical and foundation investigations would be conducted during final design to confirm this.

5.3.1.3 Operation

The geological hazards which would exist during construction, discussed above in Section 5.3.1.2, would also be present during operation of the proposed power plant. However, due to the extended operating life of the plant, the potential for a particular hazard to occur is more likely than during construction. While the probability is low that an earthquake capable of producing strong ground motion and surface rupture would occur, the damage from such an event could be significant if structures are not designed for these conditions. The potential for groundshaking or earth

movement to damage proposed facilities is, therefore, considered a potential significant impact.

Flooding within Toano Draw Subbasin would be likely during the operational life of the plant. The impact from such an event is discussed in Section 5.3.1.2. Rockfalls, landslides, and debris flows would be of little concern at the plant site.

5.3.2 ALTERNATIVES

5.3.2.1 <u>Alternative Access Roads</u>
Both of the access road alternatives (Brush Creek and Moor Summit), would have the same impacts as the proposed action. The proposed and alternative access roads cross Toano Draw and, therefore, the 100-year flood potential is the same for each.

5.3.2.2 <u>Alternative Plant Water Supply</u>
The alternative water supply wellfields would result in differences in predicted aquifer drawdown, as discussed in the Water Resources Technical Report. Only minor, uniform settlement is expected at the plant site due to aquifer drawdown with the proposed action (Section 5.5.1.3). Impacts from the water supply alternatives would be similar to those of the proposed action.

5.3.3 MITIGATION

The geologic review of the project area indicates that geologic conditions appear to be suitable for construction and operation of the proposed action, provided that geotechnical, foundation, and flooding studies of the proposed facility, access roads, and other ancillary facilities are conducted in conjunction with final engineering, and that the recommendations of those investigations are properly incorporated into final design plans. These studies for the proposed action and/or alternatives should include the following:

- The potential for groundshaking and fault rupture at or near the plant and ancillary facilities should be determined. Facility-specific design standards for groundshaking should provide a basis for determining necessary design features to minimize damage from such an event. In the unlikely event that active faults could potentially be present within the plant site, the facilities should be located off of the fault trace, and ancillary facilities that must cross an active fault should be designed to minimize damage from fault rupture.

- The potential for liquefaction should be determined during the geotechnical investigations. Potentially liquefiable soils can be mitigated by foundation design and by removing or compacting unconsolidated or soft soil material.

- The flood zone and flow for a maximum credible flood event within Toano Draw should be verified. The plant site should be designed to enhance drainage away from facilities, and/or divert or rechannelize stormwater. Culverts or bridges placed across Toano Draw for the access road should be sized or designed for flood events.
- Ground subsidence and settlement should be predicted during the geotechnical investigations. Foundation design should include features to minimize the effect of any subsidence or settlement. These could include the use of deep foundations and/or structural (engineered) fill. Excessive groundwater withdrawal could affect rates of subsidence or settlement at the plant site, although it is unlikely to result in significant effects. Groundwater monitoring is proposed for the project, and is discussed in the Water Resources Technical Report. The geotechnical investigation should evaluate acceptable limits for subsidence and settlement, and indications of excessive or differential settlement that could adversely affect the project facilities would require modification of groundwater withdrawals.
- Reduce impacts by eliminating land areas of moderate mineral potential.

5.4 SOILS

For the purposes of assessing impacts of the land acquisition, a general comparison was made between the types and amounts of soils which would be acquired by the BLM (offered lands) and the types and amounts of soils which the BLM would exchange with the applicant (selected lands). Part of the selected land is proposed to be used for various project facilities; impacts associated with this use are discussed separately under Construction and Operation (Sections 5.4.1.2 and 5.4.1.3, respectively). To assess impacts relating to the construction and operation of the facility and its ancillary facilities, criteria were established to identify those soil characteristics which indicate the potential for significant impacts and/or the need for special or additional design, in the case of road-building and construction limitations. These criteria are:

- Slopes greater than or equal to 40 percent
- "High" wind or water erosion potential
- "Poor" or "poor-fair" reclamation potential
- "Severe" road-building problem potential
- "Severe" construction-excavation problem potential

5.4.1 PROPOSED ACTION

5.4.1.1 Land Acquisition

Under the proposed action, approximately 12,770 acres of primarily mountain and piedmont soils and 640 acres of primarily gently sloping silt

or gravelly loam would come under public domain. The mountain and piedmont soils are generally extremely steep and have characteristics that make them sensitive to disturbance (poor reclamation potential) and susceptible to erosion. The gently sloping silt or gravelly loam have fair to poor topsoil characteristics.

The lands (15,960 acres) which would be traded to the applicant also contain soils with characteristics which make them sensitive to disturbance. However, in general, they are not as shallow or steep as the Snake Mountain Range soils. Removing these lands from the public domain would eliminate Federal control of their use and could result in private use of the land which has adverse impacts upon the soils (e.g., the proposed project site and rights-of-way for various linear facilities). However, the overall effect of the land acquisition and land exchange provides for the acquisition of a relatively large, contiguous area of very steep, sensitive mountain soils by the BLM.

5.4.1.2 Construction

Construction of the power plant and ancillary facilities would disturb and alter natural soil characteristics and, in some cases, result in the permanent loss of some soil material. Direct impacts to soil potentially include:

- Loss of soil pedogenic development, including soil structure and layering
- Mixing of topsoil and subsoil/substrate
- Compaction of soil by heavy equipment
- Soil loss due to increased rates of erosion, often caused by disturbance or exposure of soils in cuts
- Reduction of soil productivity

These direct impacts to the soil resource would affect soil stability and soil suitability as a plant growth medium. The degree of susceptibility to these impacts varies with the construction activity, topography, and soil characteristics. A discussion of the individual facilities proposed and their associated soil impacts is provided below.

Proposed Plant Site. Approximately 1780 acres of soil would be altered (i.e., covered, moved, compacted) due to the construction activities. Essentially, the natural soils would be removed or replaced by the structures, roads, and other facilities proposed, including 535 acres designated for solid waste disposal areas. Most of the soil which would be affected (1077 acres within the fenced area and much of the expected landfill site location) consists of Wiffo-Nevador Association soils, which present severe construction/excavation problems due to cutbank instability. Some Toano series floodplain soils would also be directly

impacted (150 acres within the fenced areas and an undetermined additional area within the landfill sites); this soil type presents no severe construction problems. Most of the soil covering the fenced 1240-acre project site would be lost due to placement of structures and other facilities, and the remainder of the site's soils would be altered or affected by construction activities.

Access Road. Soils located within the actual roadbed limits (paving and shoulder) would be permanently lost. The remaining disturbed soils within the construction corridor would be affected by the compaction of construction equipment and disturbed by clearing and grading activities. Because these soils exhibit characteristics that make both reclamation and construction very difficult, it is expected that impacts would be significant and possibly long-term, if reclamation is not successful.

Railroad. A small portion (17 percent) of this route crosses a Hundraw-series soil, which could present extremely steep slopes (up to 50 percent) that can exacerbate existing topsoil and construction limitations and result in an increased impact to the soil resources of that area. In addition, approximately 57 percent of this route crosses soils with poor reclamation potential and construction limitations and it is expected that impacts would be significant and possibly long-term, if reclamation is not successful.

Water Pipeline. Overall, the soils along this route contain series which exhibit poor reclamation potential and present construction/excavation problems except for the Toano-Series and Wiffo-Nevador Association soils, which present "moderate" road-building problems. A small portion of this route (approximately 2 percent) consists of a Tocomar series soil association which could have extremely steep slopes, a high water erosion potential, poor reclamation potential, and possible excavation problems. In this area, the potential for increased soil loss due to erosion and minimal reclamation success could be expected.

The soils on the pipeline route would not lend themselves easily to reclamation operations because of their poor topsoil and reseeding potential. Therefore, the impacts could still be significant and relatively long-term, even though there would be no direct loss of soil due to placement of structures or facilities on the ground surface.

5.4.1.3 Operation

No significant impacts to soil resources would be expected during the operation phase of the project. Minimal disturbance from periodic truck use could occur along the access roads (unpaved) for ancillary facilities during maintenance operations, which could increase erosion on a localized basis. Other operational activities would take place on soils that would have already been affected (covered, removed) by the construction activities described previously in Section 5.4.1.2.

5.4.2 ALTERNATIVES

5.4.2.1 Alternative Access Roads

Moor Summit Access Road. Potential impacts to soil resources would be greater with construction of this alternative access road than for the proposed access road, primarily because of its total length of new construction (24 miles compared to 10 miles of new construction for the proposed road). There would also be problems with cut bank stability and poor topsoil conditions along this route.

Because most of the soils along this alternative have poor reclamation impact potential and significant slope-related impact potential, this alternative would result in a higher impact than that expected from construction of the proposed access road.

Brush Creek Access Road. Overall, approximately 94 percent of the soil associations found along this alternative route would involve significant reclamation-related impact potential, primarily due to aridity, stoniness, crusty and salty conditions, and the presence of a hardpan. Approximately 83 percent of the route's soils exhibit significant construction/slope-related constraints. Because the Brush Creek alignment is all new construction and does not utilize any existing roads, it is expected to have a slightly higher impact.

5.4.2.2 Land Acquisition Alternatives

Right-of-Way Grants. If this alternative were implemented, this would result in actual disturbance to soils in these areas which fall within the rights-of-way or on the plant site itself (as discussed under Sections 5.4.1.2 and 5.4.1.3 above). This alternative offers no lands to the public in exchange and, therefore, there would be a loss in resource values.

Selling the Public Lands. This alternative would result in similar soil disturbances and impacts to those discussed under the Right-of-Way Grants alternative.

5.4.3 MITIGATION

A reclamation plan should be developed on a site-specific basis, after the exact locations and alignment of the various facilities are determined. The following mitigation principles for the proposed action and/or alternatives should be considered as potential means for lessening erosion and soil loss and for restoring natural vegetation cover in disturbed areas:

- Limit the extent of clearing, grading, and other soil-disturbing activities. Conduct such activities only in those areas that are to be built upon, to be used during construction, or to be required to provide suitable access for construction and maintenance equipment. In addition, limit "blading" of dirt access roads, if no clearing of vegetation is needed to allow passage of vehicles.

- Clear just prior to construction activity to lessen the duration of bare soil exposure.

- Regrade disturbed soils to preserve or restore natural drainage patterns.

- Attempt to avoid steeply sloped areas and soils with high erosion potential when determining the exact alignments of railroad beds, access roads, and other linear facilities. Otherwise, cross these areas parallel to and at the base of the slope.

- Utilize erosion controls during construction activities.

- Store and replace topsoil and reseed areas to reestablish natural cover to minimize long-term soil impacts.

- Monitor disturbed areas to determine the success of mitigation measures and to identify those areas requiring restabilization.

5.5 WATER RESOURCES

5.5.1 PROPOSED ACTION

5.5.1.1 Land Acquisition

The land exchange is not expected to significantly affect water resources available to the exchanging parties. The land exchange would have no major impact on the water resources of the exchanged lands or their respective watersheds.

Acquisition of approximately 13.8 ac-ft/yr of water rights in the Snake Range would ensure the legal preservation of water-based resources, such as range, wildlife, and recreation.

5.5.1.2 Construction

Construction of TSPP and the ancillary facilities would directly affect T40N, R66E, Sections 16 to 21 inclusive, and Sections 28 to 30 inclusive, in Toano Draw Subbasin of Thousand Springs Basin, as well as the connecting utility and transportation linear facilities.

Minor surface disturbance would result from conducting the geophysical surveys required in advance of project wellfield development. The disturbance would be caused by driving light-weight, all-terrain vehicles along the lines of the surveys, in order to string and recover the communication wires required for the survey.

Impacts of well construction would be surface disturbance of an area of about 13,000 square feet (about 1/3 acre) for each well. The disturbance would include removal and/or crushing of vegetation, excavation of a mud pit, and possible leveling of the area where the drill rig would be

years per unit) construction wastewater, and therefore, the pond area need be adequate only for accommodating the wastewater associated with power plant operation.

It is expected that there would be no significant impacts on underlying groundwater by leachate from either construction or plant operating wastewaters because the proposed action includes double-lined ponds and a leachate monitoring and collection system. Containment dikes around the pond perimeters would have sufficient freeboard to prevent pond outflow that could impact off-site surface waters.

Other construction activities could use oils and/or other additives which, if released to the environment, could cause degradation of surface water and/or groundwater.

5.5.1.3 Wellfield Operation

This subsection discusses potential impacts to surface water and groundwater resulting from the proposed action for wellfield pumping. The potential water resources impacts of pumping at rates of up to approximately 32,000 ac-ft/yr for the anticipated 49-year life of the power plant project (from startup of Unit 1 to final shutdown of Unit 8) were evaluated.

Potential impacts due to power plant water uses would increase progressively as more units are put in operation and as the duration of use increases. Extending the intervals between units would generally reduce the impacts because the number of years that all units would be operating concurrently would be reduced.

The TSPP water requirements would be supplied from wellfields that tap the groundwater resources of Thousand Springs Basin. As a result, the present equilibrium of the groundwater system would be modified. One potential result of this modification would be that some of the water which presently discharges from the basin into Utah as streamflow would instead infiltrate to groundwater and could be captured by the project wellfield in the Gamble Ranch vicinity. Also, less groundwater would discharge from the basin to Utah than under present conditions. The potential water resources impacts of the proposed action would become more substantial as the project was developed to full scale.

As a tool for assessing environmental impacts of groundwater withdrawals for TSPP, numerical and analytical groundwater flow models were utilized (Water Resources Technical Report, Sections 8.0 and 10.0). Results of these models have provided useful insights into the effects of pumping. However, it is recognized that these models are approximate in nature because of limitations in the available data base and the lack of historical records of the effects of large-scale pumping in the basin. For this reason, the following discussion on impacts is based on interpretation of the flow modeling results. In the description of impacts herein, if there is a reasonable possibility of an impact occurring, it is conservatively assumed that the impact would occur.

placed. Also, there would be some surface disturbance to provide access to the well site from the nearest existing cleared vehicle track in the area. This disturbance would be relatively minor because all of the equipment involved with the well construction would be able to travel across the type of terrain and vegetation present in the area, with no prior need for clearing the way, and most of the vegetation that is surficially disturbed by the traffic would be expected to recover soon after the end of the traffic.

Culverts under important transportation arteries, e.g., plant main access road and the railroad spur, would be designed to pass a peak stormflow having a probability of occurring once in 100 years. Culverts under facilities that could be breached without serious consequences to people or plant safety or operations would be designed to pass not less than peak flows from storms having a probability of occurring once in 25 years. Installation of the culverts would be done at times when there was little or no flow in the channels and there would be no significant water resource impacts from the installation and operation of the culverts or from potential washout during peak flooding events.

Culvert installation, probably of box-type reinforced concrete, at Thousand Springs Creek, for construction of the proposed access road, would require disturbance of the creek bed to prepare a foundation for the boxes and to place compacted backfill between the pipes and between the boxes. The creek bed disturbance would cause muddying of the flow in the creek for a few hours. It is expected that the suspended soils concentration in the water would be comparable to the concentration during annual high flows in the creek and, therefore, this temporary disturbance of the creek bed would not be considered a significant impact.

Construction of the access road embankments, on the approaches to the creek crossing, is expected to cause no significant impacts on the water resources of the area.

The impacts to the water resources of Toano Draw Subbasin and Thousand Springs Basin as a whole, resulting from construction uses of water, would be insignificant.

No significant impacts to surface water or groundwater would be expected from the relatively small quantity of dilute sewage temporarily stored in the oxidation lagoon. Due to the duration that this lagoon would be in operation (i.e., 2 years) and the depths to groundwater in this area (i.e., greater than 100 feet), it is unlikely that the dilute sewage would percolate to the groundwater.

During the construction period, there would be approximately 10 gpm, or about 10 ac-ft/yr, of wastewater, generated by the construction activities, including sanitary wastes from the construction-worker camp. Each zero discharge evaporation pond would have a storage capacity of about 250 ac-ft, and this capacity would be adequate to accommodate the short-term (2

A summary of the incremental impacts associated with the addition of each unit for its assumed operating life of 35 years is provided in Table 5.5-1. These potential impacts, as they relate to the specific wellfields proposed, are discussed below.

Wellfield in Toano Draw Subbasin. As noted above, the proposed action would be to produce groundwater from a single wellfield in the Toano Draw area (subbasin) to supply Units 1, 2, and 8. Numerical modeling of groundwater flow in the Toano Draw alluvial aquifer (Water Resources Technical Report, Sections 8.0 and 10.0) indicates that the aquifer could be pumped at a rate adequate to supply the water requirements for three generating units, i.e., 12,000 ac-ft/yr for the planned operating life of the units (35 years each). The numerical groundwater flow model was calibrated to presently existing conditions prior to simulating the effects of pumping to supply Units 1, 2, and 8 (12,000 ac-ft/yr). However, it is important to note that the conservative case of this flow model does not consider the additional water resource available to supply the plant that may be derived from curtailment of present irrigation uses within or upstream from the model area. The model also does not consider the additional groundwater recharge that occurs north of the Toano Draw and Thousand Springs Creek, and Thousand Springs Creek upstream of Toano Draw. Current water uses for irrigation upstream from Twentyone Mile Dam (about 6000 ac-ft/yr, net) would be progressively reduced to zero as agricultural activities were phased out. Therefore, the relatively small magnitude of the simulated drawdowns in areas adjacent to the creek indicate that pumping to supply three units would not appreciably impact flows in Thousand Springs Creek, which is presently an ephemeral stream with highly variable flows and some seasonally dry reaches.

Present expectations are that a single wellfield located south of the power plant site could be developed to supply three generating units. In this case, the results of flow modeling indicate that the maximum groundwater level drawdown, which would occur in the vicinity of the wellfield, would be about 70 feet. As a result of the great distance--about 12 miles--between Thousand Springs Creek and the proposed wellfield, there would appear to be minor groundwater level drawdown along Thousand Springs Creek throughout and following the project operating life.

Analyses of groundwater quality in the Toano Draw indicate high SiO_2 concentrations, which probably are a result of the high radioactivity of the volcanic glasses in the sediments that allow for rapid dissolution of SiO_2-containing phases. Considering the potential importance to power plant use, the high levels of SiO_2 in the groundwater in Toano Draw will be further evaluated and, if needed, the water would be treated prior to use by the plant to reduce the SiO_2 content of the water to appropriate levels.

Other environmental effects that could occur if the Toano Draw alluvial aquifer were developed to supply three generating units would be as follows:

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a] Streamflow in 1000 Springs Creek	Flow from Springs or Wells	Wetland/Riparian Habitat
1	1990-94	•Develop wellfield to supply 4000 ac-ft/yr in Toano Draw south of plant site.	No expected changes in flow in Thousand Springs Creek upstream from Twentyone Mile Reservoir.	No expected effects.	No expected effects.
	1990→	•Initiate surface water and groundwater monitoring programs in Toano Draw and Gamble Ranch areas, operate through life of plant.			
	1994-2029	•Unit 1 operation.	No expected changes in flow in Thousand Springs Creek.	Potential reduction in springflow (Mud, Lower Deadman, and Pequop springs) and increased pumping lifts in wells in southern Toano Draw area.	No expected effects.
	1995→	•Reduce irrigation diversions from Thousand Springs Creek upstream from Toano Draw by amount equal to Unit 1 water requirements. •Supply water to wildlife at impacted springs and wells.			Portions of Winecup Ranch hay meadows would revert to alkali meadows.

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION (continued)

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a] Streamflow in 1000 Springs Creek	Impacts[a] Flow from Springs or Wells	Impacts[a] Wetland/Riparian Habitat
2	1994-96	•Expand wellfield to supply additional 4000 ac-ft/yr in Toano Draw south of plant site.	No reduction in streamflow during average or above average runoff years.		
	1996-2031	•Unit 2 operation.	Drawdown of water table near creek in northern Toano Draw may reduce natural streamflow above Twentyone Mile Reservoir during drought conditions.	Potential loss or reduction in flow from springs in southern Toano Draw. Increased pumping lifts from stock-watering wells in Toano Draw.	No significant impacts to wetland vegetation bordering springs.
	1996+	•Terminate all irrigation diversions from Thousand Springs Creek upstream from Twentyone Mile Reservoir.			Hay meadows in Winecup Ranch would revert to alkali meadows, and some alkali meadows may revert to upland shrub.
3	1995-98	•Develop wellfield to supply 4000 ac-ft/yr in Gamble Ranch vicinity starting at the north end of Thousand Springs Creek valley near the confluence with Crittenden Creek.			
	1998	•Construct transmission pipeline to plant site.			

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION (continued)

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a] Streamflow in 1000 Springs Creek	Impacts[a] Flow from Springs or Wells	Impacts[a] Wetland/Riparian Habitat
3, cont.	1998-2033	•Unit 3 operation.	Above Twentyone Mile Reservoir, same as for Units 1 and 2. No expected net reduction in streamflow in Gamble Ranch area.	Toano Draw same as above. No expected effects in Gamble Ranch area.	Same as for Units 1 & 2.
	1998+	•Reduce irrigation uses of surface and/or groundwater downstream from Twentyone Mile Dam by amount equal to quantity pumped to TSPP.			Portions of irrigated hay meadows in Gamble Ranch area would revert to alkali meadows.
	1998+	•Regulate water releases from Twentyone Mile and Crittenden Reservoirs in order to provide water-flow to Thousand Springs Creek.			
4	1998-2000	•Expand wellfield to supply additional 4000 ac-ft/yr in Gamble Ranch area.			
	2000-2035	•Unit 4 operation.	Above Twentone Mile Reservoir, same as above. No reduction in streamflow during average or above average runoff years below Twentyone Mile Reservoir. Some reduction in streamflow and underflow to Dake Reservoir during drought conditions.	Toano Draw same as above. Potential reduction in flow from springs (e.g., Gamble and other unnamed springs) along Thousand Springs Creek in Gamble Ranch area. Increase in pumping lifts in Gamble Ranch area.	No significant impacts to riparian community in Gamble Ranch area or to the Dake Reservoir marsh complex.

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION (continued)

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a]		
			Streamflow in 1000 Springs Creek	Flow from Springs or Wells	Wetland/Riparian Habitat
4, cont.		•Reduce irrigation uses of water downstream from Twentyone Mile Dam by amount equal to quantity pumped to TSPP.			Additional acreage in irrigated hay meadows would revert to alkali meadows.
5	2000-02	•Expand wellfield to supply additional 4000 ac-ft/yr in Gamble Ranch area.			
	2002-37	•Unit 5 operation.	Toano Draw same as above. Reduction in streamflow in Gamble Ranch area during extended dry periods. Increase in TDS.	Toano Draw same as above. Reduction in flow from a few springs in Gamble Ranch area. Increase in pumping lifts in Gamble Ranch area.	No significant impacts to riparian community in Gamble Ranch area or to the Dake Reservoir marsh complex.
		•Terminate all irrigation uses of water downstream from Twentyone Mile Dam.			The majority of irrigated hay meadows would revert to alkali meadows. Some alkali meadows in hay meadow complex would revert to upland shrub habitat.
6	2002-04	•Expand wellfield to supply additional 4000 ac-ft/yr in Gamble Ranch area.			

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION (continued)

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a] Streamflow in 1000 Springs Creek	Flow from Springs or Wells	Wetland/Riparian Habitat
6, cont.	2004-39	•Unit 6 operation.	Toano Draw same as above. Reduction in streamflow in Gamble Ranch area during extended dry periods. Increase in TDS.	Toano Draw same as above. Reduction in flow from springs in Gamble Ranch area. Increase in pumping lifts in Gamble Ranch area. Reduction in inflow to Dake Reservoir during extended dry periods.	During extended dry periods, reduction in underflow to the Dake Reservoir marsh complex could result in its conversion to alkali meadow.
7	2004-06	•Expand wellfield to supply additional 4000 ac-ft/yr in Gamble Ranch area.			During an extended dry period (more than 1 year), reduction in underflow to the Dake Reservoir marsh complex could result in its conversion to alkali meadow.
	2006-41	•Unit 7 operation.	Toano Draw same as above. Reduction in streamflow in Gamble Ranch area in dry periods. Increase in TDS.	Toano Draw same as above. Reduction in flow from springs in Gamble Ranch area. Increase in pumping lifts in Gamble Ranch area. Reduction of inflow to Dake Reservoir. Under extended dry periods and extreme conditions water level in Dake Reservoir could be lowered below historic levels or emptied completely.	
8	2006-08	•Expand wellfield to supply additional 4000 ac-ft/yr in Toano Draw south of plant site.			

Table 5.5-1. PREDICTED WATER RESOURCES IMPACTS, BY GENERATING UNIT AND TIME FRAME, OF THE PROPOSED ACTION (concluded)

Unit	Time Frame (years)	Summary of Proposed Major Water Supply Related Actions	Impacts[a]		
			Streamflow in 1000 Springs Creek	Flow from Springs or Wells	Wetland/Riparian Habitat
8, cont.	2008-43	•Unit 8 operation.	Gamble Ranch same as above. Decrease in streamflow in reach between Toano Draw and Twentyone Mile Reservoir. Increase in TDS.	Gamble Ranch same as above. Loss of or reduction in flows from springs in Toano Draw area and drawdown of water table during extended dry periods. Increase in pumping lifts in the Toano Draw area.	No increase in potential impacts to the Dake Reservoir marsh complex because additional water would be extracted from Toano Draw area. No significant impacts to riparian vegetation upstream from Twentyone Mile Reservoir because the alkali meadow/hay meadow complex would continue to receive surface runoff.

[a] See text of Section 5.5.2.1 for a more detailed description of potential water resource impacts of the proposed action.

- Minor land surface subsidence could occur in areas of maximum groundwater level decline. Subsidence at the power plant site would be expected to be less than at the wellfield, and no significant differential settlement would be expected across the plant site.

- Groundwater level drawdowns could necessitate setting the pumps deeper in a few existing stock-watering wells, which are located in the area of the proposed wellfield, in order to maintain production. Pumping costs would increase in direct proportion to the increased lift resulting from groundwater level decline.

- A few existing springs around the perimeter of the Toano Draw valley (e.g., Mud, Deadman, and Pequop Springs) could be hydraulically interconnected with the water table in the Toano Draw alluvial aquifer, and lowering of the water table in Toano Draw may reduce or eliminate the discharge from those springs.

- Irrigation of pasture and hay lands along Thousand Springs Creek upstream from Twentyone Mile Dam would be phased out and, therefore, the productivity of the land for producing hay and grass for cattle would be reduced.

- Some unnamed springs presently discharging to Thousand Springs Creek, downstream from Twentyone Mile Dam, could be connected by deep flow lines to the Toano Draw alluvial aquifer. If the recharge zone for those springs were within the zone of drawdown, then the discharge from those springs could be affected.

- There could be degradation of both surface water and groundwater quality primarily because of increased total dissolved solids in the lower, downstream areas of Thousand Springs Basin as a result of project water withdrawals from the Toano Draw aquifer.

<u>Wellfield in Gamble Ranch Vicinity</u>. The proposed plan for utilization of the water resources in this area is to supply generating Units 3 through 7 from a single, progressively enlarged wellfield in the area. The total demand on the wellfield would be 20,000 ac-ft/yr.

The current 9000 ac-ft/yr net consumptive irrigation use in the area, downstream from Twentyone Mile Dam, would be progressively curtailed to zero would be greater than the water requirements of two generating units (Units 3 and 4). The reduced agricultural production (mainly hay crops), due to converting water now used for irrigation to the proposed industrial use, is not considered a significant impact. However, there could be impacts to wildlife and riparian areas resulting from the elimination of irrigated pasture lands in the Gamble Ranch area. These impacts are similar to those addressed for Toano Draw Subbasin and are discussed in Section 5.6.1.

To supply Units 5 through 7, pumping of the Gamble Ranch wellfield potentially would reduce streamflow in Thousand Springs Creek, particularly during extended dry periods. However, the wellfield development and water management plan would be oriented towards maintaining flows in Thousand Springs Creek, and the water level in Dake Reservoir, as near their current levels as reasonably possible, and trying to capture groundwater now being discharged to Great Salt Lake Basin. To the maximum practical extent, the level of Crittenden Reservoir would be maintained above the minimum pool elevation established by past practices. The estimated present groundwater discharge to Utah through the upper alluvial aquifer is about 30,000 ac-ft/yr or more. Groundwater discharge to Utah would probably be reduced by the amount the total basin extraction would exceed the current net consumptive use in the basin. It is estimated that the proposed power plant usage of 32,000 ac-ft/yr would reduce the discharge to Utah by about 17,000 ac-ft/yr, given that the present consumptive use by irrigation (about 15,000 ac-ft/yr) would be eliminated to supply the plant.

Reduction of groundwater discharge from the Montello area to Great Salt Lake Basin, under present conditions, would not adversely impact the lake and may be economically beneficial. Rising lake levels starting in the early 1960s have caused severe economic distress on much property surrounding the lake during the past few years. It is not known if the current trend of a rising lake level will continue, but it is believed that a stable or receding lake level would be generally preferred.

An analytical groundwater flow model developed for the Gamble Ranch vicinity (Water Resources Technical Report, Section 8.0) indicated that the maximum groundwater level drawdown within the wellfield area would reach about 40 feet. This flow model anticipates that the water now used for irrigation would be used instead to recharge the aquifer. Under this condition, it is expected that during periods of low flow in Thousand Springs Creek, all of the natural streamflow would probably infiltrate before reaching Dake Reservoir (privately-owned). Controlled releases of stored water from Crittenden and Twentyone Mile reservoirs would be made to augment natural streamflow and thus contribute water to Dake Reservoir. However, because the minimum pool elevation of Dake Reservoir may be maintained by groundwater, and thus related to the position of the water table, there may be noticeable effects on Dake Reservoir created by pumping from the project wellfield in the Gamble Ranch area. The results of this flow model indicate that about 8 to 12 feet of drawdown of the water table may occur in the area near Dake Reservoir after 35 years of pumping at a rate of 20,000 ac-ft/yr. During extended dry periods (lasting longer than 1 year), groundwater flow and recharge to Dake Reservoir may be significantly reduced by pumping of the Gamble Ranch wellfield and, under extreme conditions, Dake Reservoir could be lowered below historic levels or emptied completely.

There is not expected to be any effect of wellfield pumping (i.e., drawdown) on the level of Crittenden Reservoir because it is located several miles upstream and at a significantly higher elevation than the project wellfield proposed in the Gamble Ranch vicinity.

Other expected effects of pumping the Gamble Ranch vicinity wellfield would be as follows:

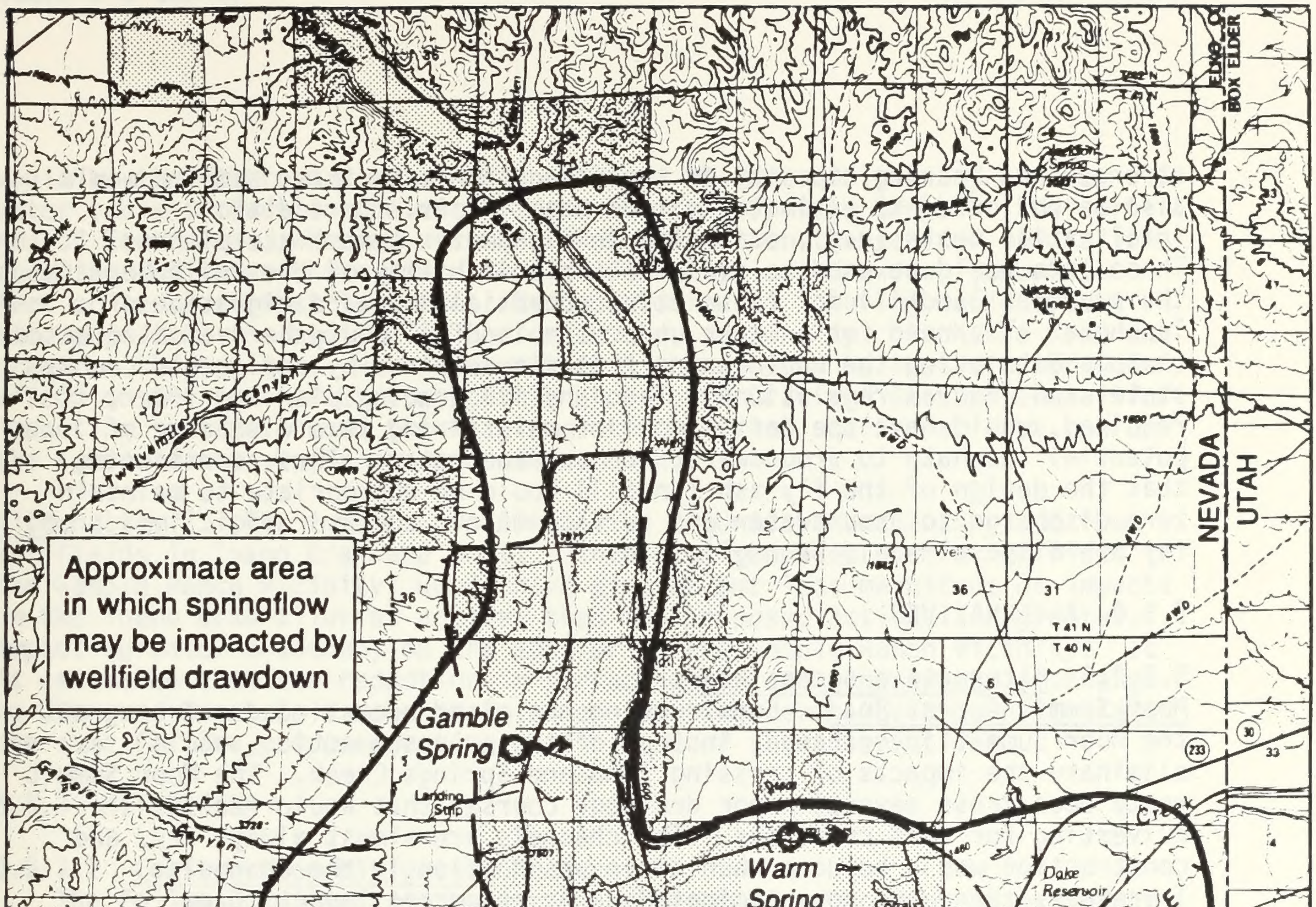
- Discharge from springs within the perimeter of the drawdown area (e.g., Gamble and Warm Springs) could be reduced or eliminated. Figure 5.5-1 shows the area in which potential impacts to springs could occur.
- Pumping lifts in stock-watering wells within the area would be nominally increased.
- There probably would be degradation of surface water and groundwater quality in the area because of increased TDS content. The change in water quality would likely increase in proportion to the increase in pumping rate from the wellfield and with time.
- Minor land surface subsidence could occur in areas of maximum groundwater level decline.

Lowering of the water level in the Toano Draw aquifer would be an impact related to the duration of pumping of the aquifer. After project termination (i.e., 49 years), the aquifer level would be progressively restored to pre-project levels, as would the discharge to the alluvial channel and aquifer underlying Thousand Springs Creek. The groundwater flow model, developed for simulating the alluvial aquifer response to pumping, indicates that the aquifer recovery rate, related to its pre-project configuration, could progress approximately as follows:

Years After End of Pumping	Percent Recovery
25	50
50	70
100	100

5.5.1.4 Power Plant Operation

Power plant operation would require the disposal of plant-generated ash and scrubber byproduct in a landfill. Detailed geotechnical studies of the power plant site are planned. These studies would collect data on soil characteristics beneath the proposed plant facilities, including the landfill. At the time that sampling of borings is conducted at the plant site to characterize the soil physical properties, e.g., to evaluate the



LEGEND

Lands Owned by Lands of Sierra, Inc.

Outlines of Areas Where Hydrogeological Conditions Appear Favorable for Wellfield Development

Springs

Figure 5.5-1. APPROXIMATE AREA OF SPRINGS POTENTIALLY IMPACTED BY WELLFIELD DRAWDOWN, GAMBLE RANCH AREA

strength and bearing capacity of the foundation materials, samples would also be collected to estimate soil permeabilities. In addition, infiltration tests (e.g., dual-ring infiltrometer tests) are planned. These data would be used to evaluate the suitability of the soils beneath the proposed landfill for restricting potential downward migration of leachate. The need for a liner under the landfill would be evaluated based on this data using the engineering criteria required by applicable county, state, and Federal regulations. The landfill grading plan and liner, if required, would have the design goal of maintaining zero discharge of potential leachate to groundwater and surface water. Thus, considering that the design of the fly ash landfill would be appropriate to maintain zero discharge to groundwater and surface water, the hydrologic impact of fly ash disposal would be negligible.

5.5.2 ALTERNATIVES

5.5.2.1 Alternative Access Roads

Moor Summit Access Road. Constructing the plant access road starting at the Moor Summit interchange, instead of the proposed action, would eliminate the impacts of crossing Thousand Springs Creek. The Moor Summit route does cross several minor drainage courses that would require culverting for road crossings. The channels are almost always dry, and construction would be done when there was no flow in the channels. Therefore, there are no anticipated water resources impacts from construction of this alternative.

Brush Creek Access Road. The alternative would require the crossing of Brush Creek, and several other minor, unnamed drainage courses, but it would eliminate the impacts of crossing Thousand Springs Creek. The road construction would be accomplished during the summer season, when there rarely would be flow in any of the drainage channels at the crossing points, and, therefore, it is expected that there would be no significant water resources related impacts from installing the required culverts in the channel crossings with this alternative. However, if construction occurred during a period when water was flowing in the creek, then impacts would be similar to those discussed for the proposed access road but would likely be of a lesser magnitude.

5.5.2.2 Alternative Construction-Worker Accommodations

The water resources impacts of not including a construction-worker camp, to temporarily accommodate construction workers, would be marginally less than with the proposed action because less of the basin's resources would be used to supply the plant construction water requirements, and there would be less construction wastewater for disposal.

5.5.2.3 Alternative Plant Water Supply

Alternative 1. The impacts of Alternative 1 (Units 1 and 2 supplied from a wellfield south of plant site, Unit 8 supplied from a wellfield northwest of plant site, and Units 3 through 7 from the Gamble Ranch vicinity) would be similar to the impacts of the proposed action. The major differences

would be that there may be as much as 15 to 20 feet of lowering of the water table surface in the vicinity of Thousand Springs Creek at the north end of Toano Draw, whereas with the proposed action the aquifer simulation modeling indicates there would be significantly less drawdown (about 10 feet or less) at that location. Groundwater level lowering would affect discharge from the aquifer to the creek and, seasonally, discharge from the creek to the aquifer. With Alternative 1 there would be less of a drawdown effect on the aquifer at the south end of Toano Draw and less potential for impacting springs around the margin of the alluvial aquifer at that end of the subbasin than under the proposed action.

Alternative 2. The impacts of Alternative 2 (Units 1 and 2 supplied from wellfields in Toano Draw and Units 3 through 8 supplied from a wellfield in the Gamble Ranch vicinity) would have similar but less magnitude of impacts on the Toano Draw alluvial aquifer than the proposed action, and greater impact (greater drawdown) on the aquifer in the Gamble Ranch vicinity. It is estimated that the reduction in surface water and groundwater discharge to Utah and Great Salt Lake Basin, over the long term, would be essentially the same for the proposed action as for each of the alternatives.

5.5.3 MITIGATION

5.5.3.1 Construction Mitigation Measures

The following mitigation measures are recommended to prevent or reduce water resources impacts due to construction of TSPP:

- Anticipated impacts associated with construction of wells, and the access corridors, pipelines, and electric distribution lines for serving the wells, should be mitigated by removing all equipment, supplies, and debris from the work areas; regrading the disturbed areas to essentially their original configuration; preparing the soil; and reseeding the disturbed areas with a mix of introduced and native vegetation. Fast-growing species should be included in the seed mix to provide for rapid cover and to limit erosion impacts.

- In areas where disturbance of the land surface could significantly increase erosion and sediment transport to Thousand Springs Creek, it may be necessary to implement appropriate engineering measures (e.g., jute netting, retention berms, and ponds) to restrict sediment from entering the creek.

- A hazardous materials program should be planned, implemented, and monitored to prevent and detect releases of hazardous materials and hazardous wastes to surface water and groundwater. The applicant would have complete liability for any waste spills or leaks regardless of land ownership. The construction-phase program should be designed and implemented in accordance with requirements and guidance from the BLM and the NDEP. The program should include worker health and safety training, worker right-to-

know, contingency planning, chemicals and waste storage and handling protocols and training, materials and waste characterization, waste minimization, resource conservation and recovery, and hazardous materials substitution with nonhazardous alternatives.

- All hazardous materials and wastes should be stored, used, and eventually disposed of in a manner which minimizes releases to water resources and the environment. Appropriate hazardous materials and hazardous waste manifest tracking and inventory system should be established, including monitoring of materials and the adjacent environment.

- Construct wildlife water troughs one mile apart off the proposed waterline from the Gamble Ranch area wellfield.

- Locate construction lay-down areas and vehicle maintenance activity areas away from stream crossings.

- Designate a BLM liaison to review applicant's monitoring.

- Construct a package sewage treatment plant.

5.5.3.2 Operation Mitigation Measures

The following mitigation measure is recommended to prevent or reduce water resources impacts due to operation of the TSPP:

- As described in Section 3.1.4.4, the plant water system would draw upon wellfields, the effects of which would be routinely monitored. A series of monitoring wells and key springs would be observed to determine if specific mitigation measures might be necessary. If significant impacts are observed or are judged to be imminent, the applicant should work with the State Engineers Office, NDOW, and the BLM to define and implement appropriate mitigation measures.

5.6 ECOLOGICAL RESOURCES

5.6.1 PROPOSED ACTION

5.6.1.1 Land Acquisition

The land acquisition would result in an exchange of ecological resources associated with offered and selected lands. The summary of types and amounts of wildlife and aquatic habitat for game and other important wildlife species contained within the exchange lands is provided in Table 4.6-1.

The proposed action would increase the quality of vegetation held on public lands. A net gain of 1509 AUMs (animal unit months) for cattle would result through the proposed land exchange. On the offered lands there is a total of 31 designated aquatic habitat types consisting of springs, seeps and ponds (BLM 1986a) and 8.1 miles of streams (Table 4.6-1). In contrast, there are no known seeps or springs located within the Federal exchange lands (Figure 4-1, Water Resources Technical Report).

There would be a net gain of 6405 acres of mule deer habitat under BLM management. There would be a net loss of elk (-1479 acres), antelope (-156 acres), and sage grouse (-160 acres) habitat under BLM management. There could be an additional net loss of unidentified sage grouse brooding/nesting habitat within a 2- to 3-mile radius of three known leks in the vicinity of the proposed plant site. The information available currently indicates that one of these leks is on Lands of Sierra, Inc. land, and therefore would not be included in the land exchange. Nonetheless, there would be a total net gain of 4610 acres of habitat for important wildlife species under BLM management. Furthermore, the BLM would gain 8.1 miles of additional stream habitat including 6.9 miles of coldwater fishery. Thus, the proposed action would ultimately increase wildlife habitat on public lands. The loss of wildlife habitat under BLM management does not mean a physical loss of habitat for wildlife.

5.6.1.2 <u>Construction</u>

The proposed action would affect approximately 1240 acres surrounding the plant site and 540 acres for routing of ancillary linear facilities that would either directly or indirectly impact vegetation and wildlife. For many impact categories discussed below (e.g., increased hunting pressure and animal-vehicle collisions), the same types of impacts would occur during construction and operation of the proposed power plant. For these categories, the impacts would be discussed under construction and are not repeated for operation of the project.

<u>Vegetation</u>. Potential construction-related impacts to vegetative resources include the following general categories:

- Disturbance to rare or unusual vegetation species or habitat types, both short-term (less than 5 growing seasons) and long-term (greater than 5 years or 5 growing seasons)

- Impacts to relatively common vegetation species or habitat types

- Permanent loss of productive capacity (site quality) in some areas

Approximately 1780 acres of vegetation would be removed in the plant site area due to construction of the plant, construction-worker camp, wastewater ponds, storage areas, and other ancillary facilities. The majority of the vegetation removed would consist of black sagebrush, shadscale, saltbush, and big sagebrush. This impact is considered long-

term because vegetation would not recover during the life of the project (approximately 60 years). Although the loss of vegetation would be adverse and long-term, it would not be considered a significant impact to animal or plant habitat, game, or livestock production because of the relative abundance of these and similar resources in the region.

Approximately 540 acres of vegetation would be removed or disturbed by construction of railroad access, road access, and water pipelines. With the exception of one access road crossing on the Thousand Springs drainage near Winecup Ranch (Figure 3.1-2), none of the affected vegetation types are unique in the regional area and would represent a relatively small percentage of regional vegetation. If disturbed areas are not properly reclaimed, recovery may not occur for 20-30 years because of the soils, climate, and slow recovery of native species in the project area.

As noted above, the road crossing of Thousand Springs Creek near Winecup Ranch would disturb a small area of wetland vegetation. The total area of wetland vegetation affected (assuming a 100-foot-wide corridor of disturbance) would be approximately 2.25 acres.

No listed or candidate threatened and endangered plant species would be affected by construction of the power plant.

<u>Wildlife and Aquatic Resources</u>. The impact analysis presented below focuses on several important categories of wildlife and associated crucial habitat: recreationally or commercially important species (generally game species); species characterized by uncertain or declining population status; threatened or endangered species; and species expected to be sensitive to project activities and which, as a result, may not be capable of sustaining current populations. Crucial habitat is defined as an area that is important for the maintenance and perpetuation of wildlife populations. Generally, these areas are characterized by population concentrations during crucial periods (e.g., winter range, breeding or brooding grounds). Within these areas, populations are very susceptible to human disturbance and effects on individuals which may result in the loss of several generations. Species not included in categories designated as "important" include songbirds, small mammals, reptiles and amphibians, and insects. These species are not generally considered recreationally or commercially important, since they are usually capable of rapid recovery and repopulation of disturbed areas due to their large populations, rapid turnover rates, and mobility.

In order to evaluate the significance of impacts, both the quantity and quality of potentially affected habitat, as well as impact duration, were considered. In general, crucial wildlife habitat areas were considered most significant.

Impacts to wildlife and aquatic resources resulting from the proposed TSPP project components are discussed in two general categories:

- Direct impacts, which are caused by the action and occur at the same time and place.
- Indirect impacts, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

Direct Impacts. Direct impacts on animals would include loss of wildlife populations as the result of construction of the proposed project components, or by destruction of habitat crucial to the animals' survival. Leks are crucial habitat and could receive impacts if access routes are constructed in close proximity to strutting grounds. Additional impacts could occur to leks if the wellfield powerlines are not buried or made perch-proof. Approximately 1240 acres of wildlife habitat supportive of big-game, small- and medium-sized mammals, raptors, nongame birds, reptiles, and amphibians would be removed. An additional 540 acres of wildlife habitat would be removed for construction of ancillary linear facilities. The majority of habitat lost by construction activities consists of sagebrush/uplands. However, none of the affected area is considered crucial habitat; therefore, no significant impacts were identified as the result of this habitat removal.

There would be no impacts to any listed or sensitive threatened or endangered wildlife species.

Indirect Impacts. Indirect impacts include the potential for population declines of displaced individuals and existing populations in habitats which are exposed to increased hunting and fishing pressures, poaching, and effects resulting from increased human activity, such as noise, dust, harassment, road mortalities, or simple human presence in areas formerly isolated.

Increases in hunting/trapping and fishing pressures due to construction-related increased population projections would likely result within the study area. Impacts concerning increased hunting and fishing pressures are discussed in more detail in Recreational Resources, Section 5.10.

Animal-vehicle collisions within the study area could also increase with the expanding population from inmigration. Higher traffic volume on highways, project-related access roads, and railways could result in increased road and railroad mortalities for big-game species. Occurrences of road mortalities would likely be higher in areas where there are big-game migration routes.

Four to five hundred mule deer migrating through the Thousand Springs Creek area near Winecup Ranch is appreciably less than other nearby areas

such as the Pequop Mountains. These animals would be susceptible to collisions as they cross the proposed access road and Highway 93 just north of Wilkins. Although information on deer road kills in this area is not well documented, during the 1987 and 1988 fall migrations less than 20 deer were found dead along Highway 93 near Wilkins (J. Williams 1989). Animal/vehicle collisions would increase along Highway 93, as well as the proposed access road, in proportion to the increased traffic along these roads from project implementation.

If access and railroad right-of-way fences were constructed too close together, big game, particularly mule deer, could be frightened when caught between traffic and the fences. Such a panic could result in an increase in animal-vehicle collisions or entanglements. Such occurrences would likely be greater during spring and fall mule deer migrations when large numbers of animals could be negotiating these rights-of-way at any given time.

An increase in the number of poaching and random shooting violations of big game, raptors, doves, grouse, waterfowl, and other wildlife within the affected area would be expected to occur due to the increase in population. Estimates for potential increases in annual mule deer poaching instances due to the power plant construction and operation workforce vary from approximately 10 (low population years) to 35 (peak population years).

Indiscriminate or random shooting of raptors is considered to be one of the major mortality factors for raptors and could increase within the affected area as a result of the proposed project. Indiscriminate shooting could have an impact on raptor populations, depending upon the extent of increased shooting and the species involved. These impacts are considered to be long-term because the potential effects of shooting on raptor population levels would likely occur throughout the construction phase of the project. Currently, there is no information to estimate increased raptor shootings as a result of the proposed project.

Noise, vehicular movement, and harassment from increased human presence/activities could result in stress-related impacts to antelope, mule deer, and elk. Daily or seasonal movements could be affected as well as feeding habits. Short- or long-term impacts such as displacement to adjacent habitats could result locally, although these are not expected to be significant.

The proposed access road and water supply pipeline would be located near three known sage grouse strutting grounds. One strutting ground is located on the western border of Toano Draw (northwest of the proposed plant site), another is very close to the proposed plant site, and the last is located along the pipeline route from the Gamble Ranch wellfield (Figure 4.6-5). If construction occurs near a lek during strutting season, there would be a significant impact. Although sage grouse may continue to utilize strutting grounds after road or pipeline construction, continual activity along the access road would cause these populations to disperse to

other areas. If wellfield powerlines are not buried or made perch-proof, raptor predation would ultimately result in significant losses to leks.

Interruption of migration corridors could result in displacement of animals to less than optimal habitat, thereby reducing population levels, e.g., lower winter survival rates in less than optimal habitat. These impacts may be cumulatively significant if lower population levels result in fewer hunter/recreation days (refer to Section 5.10 for further discussion regarding impacts to recreation). Since the proposed access road and railroad routes would be fenced, mule deer (400 to 500 individuals) migration or local movement corridors crossing the roadway would be impeded. Also, impeding migration corridors could force the animals to use less than optimal habitat. Predominantly, this road is in areas unoccupied by mule deer. However, interruption of one migration corridor near Thousand Springs Creek would result in impacts to mule deer migration (Figure 4.6-4).

Entanglement is an additional impact that could occur where mule deer corridors are interrupted by fenced access. Migrating mule deer leaving wintering ranges are in a weakened state and are therefore more susceptible to entanglement as well as animal/vehicle collisions.

Since Toano Draw is also an important antelope area, fencing utility corridors could cause significant impacts to antelope by restricting daily movement patterns.

Spread of disease and infection could occur with exposure of birds to wastewater ponds. However, according to NDOW observations of wastewater ponds at the Valmy power plant, no significant impacts to birds occurred from use of the ponds (Erickson 1989).

These impacts are considered significant and would require careful planning and consultation with the NDOW and the BLM.

5.6.1.3 <u>Operation</u>

In many cases, the potential impacts to ecological resources would be similar during construction and operation phases of the proposed project. Thus, potential impacts specific only to operation are addressed below.

<u>Bird Collisions with Power Plant Stacks</u>. It is unlikely that there would be significant mortality of birds caused by collision with the eight 450-foot power plant stacks. During periods of inclement weather, at night, during Spring migration (generally March-May) and Fall migration (generally August-November) in the project area, it is possible that deaths of nocturnal migrants would occur. The estimated magnitude of such kills is low and would probably be less than 50 individuals during any period of unfavorable conditions. This level of mortality could occur on a few nights in each migration period.

Collision mortality of birds involved in local, nonmigratory, and migratory movements during daylight periods is expected to be very low.

<u>Power Plant Emissions</u>. Hill et al. (1974) studied the response of desert plants to 2-hour SO_2 (Ecological Resources Technical Report, Table 5-2) and NO_x doses. They concluded that many of the species showed high resistance to injury from SO_2 and NO_x, and that most species did not show clear leaf damage below the 2-4 ppm range. None of the short-term maximum concentrations of emissions from the power plant would exceed the range of 2-4 ppm. Thus short-term changes in regional vegetation composition and productivity are not expected.

Eight years of observations for air pollutant damage on vegetation in the Four Corners area by Hill et al. (1973, 1978) failed to detect any visible damage from gaseous emissions. Hill et al. systematically observed native vegetation and crop and garden plants, concentrating on species most sensitive to SO_2 and NO_x. Because pollution levels in the San Juan-Four Corners area were higher than those projected for the proposed project observation area, no pollution-caused observable changes in composition or production of native communities around the proposed TSPP site are expected within a comparable time period.

Trace quantities of other compounds such as fluorides, mercury, and selenium may be released from the proposed power station. None of the emissions for these compounds is expected to result in impacts to native vegetation or crops.

Air pollutants may interact with one another to produce synergistic effects at concentrations lower than one pollutant action alone. No synergistic effects between SO_2 and NO_x were determined during fumigation studies for coal-fired emissions (Hill et al. 1974). Based on the short-term maximum concentrations expected for the proposed project, no synergistic effects are anticipated for SO_2 when combining with NO_x.

Other investigations with garden crops showed that minor concentrations of 0.10 ppm ozone and 0.10 ppm SO_2 caused damage (Tingey et al. 1973). Ozone levels at the proposed project site are expected to be low, based on measurements in remote parts of the world (0.01 to 0.05 ppm) (EPA 1986). Therefore, ozone levels are expected to be too low to produce synergistic effects when interacting with SO_2 at present levels or at the expected levels when the proposed project is operating.

<u>Acid Deposition</u>. Within Thousand Springs Basin any acid rain that is formed due to TSPP or other sources would probably be neutralized because of the high alkaline content of soils in this region. Further, since rainfall is low in this area, the occurrence of such rain would be infrequent. The potential impacts of acid rain outside Thousand Springs Basin were analyzed by examining the nearest sensitive receptors. As discussed in Section 4.1.2.3, two mountain lakes in the Jarbidge Wilderness Area (Emerald and Jarbidge lakes) were identified as sensitive receptors because

of their low buffering abilities. Based on screening procedures discussed in Section 4.1.2.3, the projected deposition and pH change in those lakes are below the USFS criteria for significance. Therefore, no significant impacts to biotic resources would be expected.

Water Supply. The proposed action is to supply the water required for three units from a single wellfield located a few miles south of the power plant site. The remaining five units would be supplied by water from a single wellfield located in the Gamble Ranch vicinity.

The results of pumping from the Toano Draw wellfield were simulated using a numerical groundwater flow model of the alluvial aquifer in Toano Draw and vicinity. These simulations indicate that with the proposed action there would be minor lowering of the groundwater level at the northerly end of Toano Draw, in the vicinity of Thousand Springs Creek. There may be a decrease in flow from the aquifer to the creek, but such a decrease would be offset by a reduction in the amount of water diverted from the creek for irrigation. Therefore, and for reasons stated in Section 5.5.1.3, pumping the wellfield would not appreciably impact flow in the creek upstream from the confluence of Crittenden Creek with Thousand Springs Creek. Accordingly, there would be few or no impacts to riparian habitat, wetlands, or aquatic wildlife along this reach of Thousand Springs Creek. Discharge from existing springs around the southern perimeter of Toano Draw Valley (Mud, Deadman, and Pequop springs) could be reduced or possibly lost by lowering the water table in the vicinity of the Toano Draw wellfield. There would be no loss of water supply to wildlife because the proposed action includes resupplying springs, seeps, and wells on public lands and springs and seeps on private lands. Impacts to associated vegetation and wildlife would be the same as discussed below for springs fed from the aquifer in the Gamble Ranch vicinity.

Downstream from Crittenden Creek, at full project development, the groundwater level within the general area of the Gamble Ranch wellfield would be lowered. Therefore, there could be some impacts to riparian habitat due to lowering the groundwater levels along the reach of Thousand Springs Creek from Crittenden Creek to Dake Reservoir. An analytical model developed to simulate the effects of pumping the Gamble Ranch wellfield indicated that the maximum water-level drawdown could be up to approximately 40 feet.

Under existing management, stream flow from Thousand Springs Creek is diverted and spread over hay meadows early in the growing season. The Hay Meadow Complex was identified in the vicinities of Winecup Ranch, Corral Canyon, Twentyone Mile Draw, and Gamble Ranch. Because irrigation of hay meadows would be curtailed in order to reduce impacts to streamflow, it is anticipated that hay meadows would change to a drier type (i.e., alkali meadows) in response to moderate depletion of available water. Surface runoff to the valley bottom is expected to maintain a moderate level of available water to hay meadows and would continue to support alkali meadows. Reduction of available water to existing hay meadows and their

conversion to alkali meadows represents a change in their biological status, e.g., a change in productivity. However, there would be no change in jurisdictional status because both hay meadows and alkali meadows are jurisdictional wetlands.

Alkali meadows associated with hay meadows would likely revert to upland shrub. Reduction of available water to existing alkali meadows and conversion to upland habitat represents a change in biological status and possibly to jurisdictional status, since there would be a loss of productivity and a change in species composition as well as a potential loss in jurisdictional wetland. The degree of change would be dependent upon the extent to which available water was reduced.

As described in Section 5.5, operation of the proposed water supply system for the TSPP would cause reduction in streamflow and, under worst-case conditions during extended dry periods, could cause reduction in alluvial discharge through the valley bottom and reduction in discharge from springs. The reductions in alluvial and spring discharge would be focused in the area downstream from the confluence of Crittenden Creek with Thousand Springs Creek (wetland impact area) (Figure 4.6-1) and would result in impacts to the biological and jurisdictional status of wetland/riparian habitats. Operation of the proposed facility would not affect surface runoff, which comprises an appreciable portion of total inflow (Rush 1968).

Underflow through alluvium and carbonate rocks forming the Gamble Range provides inflow to the wetland impact area below Crittenden Creek. Springs along the west flank of Montello Valley and seeps along the edges of lake terraces near Dake Reservoir (Figures 4.6-1 and 5.5-1) are probably linked to this underflow. Very little well-developed wetland/riparian habitat is associated with these springs which have been developed for livestock. Therefore, impacts to wetland/riparian habitat due to reduction of discharge in these springs would be relatively minor.

Seeps sustain a relatively large area of marsh complex west of Highway 233 in the vicinity of Dake Reservoir (Figure 4.6-1). This is the largest marsh complex identified. Organic soils more than 6 feet deep were described in this area. As described in Section 5.5, sustained pumping of the Gamble wellfield (supplying Units 3 through 7) during extended dry periods could reduce the water supply to these seeps. Elimination of seeps would result in impacts to wetland/riparian habitats and to wildlife. Similar wetland/riparian habitats east of Highway 233 also appear to be influenced by releases and underflow from Dake Reservoir in addition to seeps from lake terraces. The estimated areas of wetland/riparian habitats that would be affected by curtailment of irrigation and potential reduction in alluvial and spring discharge are shown in Tables 5.6-1 and 5.6-2. Curtailment of irrigation of the Hay Meadow Complex near Gamble Ranch would cause about 3179 acres of hay meadows to revert to alkali meadow and about 566 acres of existing alkali meadow to revert to upland habitat. An additional 112 acres of wet meadow would revert to alkali meadow. Most

Table 5.6-1. ESTIMATED AREAS OF WETLAND/RIPARIAN HABITATS IN THE WETLAND IMPACT AREA

Existing Wetland/Riparian Habitat	Area of Potential Impact (acres)	Change to
Curtailment of Irrigation		
Wet Meadow	112.0	Alkali Meadow
Hay Meadow	3179.0	Alkali Meadow
Alkali Meadow	566.5	Upland Shrub
Willow	45.7	No Change
Reduced Water Flow to Gambel Ranch Marsh Complex		
Marsh	254.7	Alkali Meadow
Wet Meadow	169.8	Alkali Meadow
Hay Meadow	424.5	Alkali Meadow

Source: White Horse Associates 1989 (Appendix B in the Ecological Resources Technical Report)

Table 5.6-2. ESTIMATED NET CHANGES IN WETLAND TYPES

Wetland Type	Acreage Before Project	Acreage After Project
Marsh	255	0
Wet Meadow	282	0
Hay Meadow	3604	0
Nonirrigated Alkali Meadow	0	4140
Irrigated Alkali Meadow	567	0
Willow	46	46
Upland Shrub	0	567[a]

[a] It is not certain whether the conversion of irrigated meadows to upland shrub would be a loss of jurisdictional wetland. Discussion with the ACOE will be conducted to determine the correct classification of this habitat type.

Source: White Horse Associates 1989
(Appendix B in the Ecological Resources Technical Report)

willows are situated within or near the stream channel; since streamflow would be maintained by controlled releases, no impact to the willow wetland/riparian habitat is anticipated. Curtailment of irrigation would result in conversion of about 1421 acres of crop to fallow crop land, dominated by weeds. This does not constitute a change in jurisdictional status since neither cropland nor fallow crop land are jurisdictional wetland. The Upland Shrub Complex would not be affected by operation of the proposed facility.

Under worst-case conditions (pumping of the Gamble Ranch wellfield during an extended dry period), an additional 849 acres of Marsh Complex (wet meadow, marsh, hay meadow) near Dake Reservoir would revert to alkali meadow. This would not represent a loss of jurisdictional wetlands but would result in a loss of vegetative productivity and change in species composition if the reduction in water inflow persisted over several growing seasons. Wildlife species associated with the marsh complex could be displaced by species more commonly associated with alkali meadow. Furthermore, decreased water supplies could cause vegetational shifts from wetland/riparian to upland shrub habitats resulting in concomitant changes in wildlife species dependent on these habitat types (Tables 4-3 and 4-4 in the Ecological Resources Technical Report). Changes in productivity and species composition could be short-term or long-term, depending on the length of time water flow was reduced to the existing marsh complex. The long-term loss of jurisdictional wetlands and/or loss of productivity/ species composition are considered potentially significant impacts.

In addition to potential impacts to communities along Thousand Springs Creek from Crittenden Creek to Dake Reservoir, other impacts resulting from pumping the Gamble Ranch wellfield would include reduced discharge from springs along Thousand Springs Creek within the perimeter of the drawdown area, e.g., Gamble and Warm springs. If discharge is reduced from these springs, adverse impacts to vegetation could result. Primary impacts would be degradation of associated vegetation.

Based on the proposed water supply system and controlled releases from Crittenden Reservoir, there should not be significant impacts to aquatic species in Crittenden Reservoir, Thousand Springs Creek downstream from Crittenden Creek, and in Dake Reservoir during periods of normal precipitation. Controlled releases from Crittenden and Twentyone Mile reservoirs described in the proposed action would serve to:

- Maintain flow in Thousand Springs Creek downstream of Crittenden Creek for aquatic species.

- Maintain flows to Dake Reservoir for aquatic species and recreation.

Controlled releases would be negotiated in consultation with wildlife management agencies and would be sufficient to maintain flow in Thousand Springs Creek and flow to Dake Reservoir. During extended dry periods,

(lasting longer than 1 year), water supply in Crittenden Reservoir could decline enough that controlled releases would not be possible. At the same time, groundwater flow and recharge to Dake Reservoir may be significantly reduced by pumping of the Gamble Ranch wellfield. Under these conditions, the fishery in Dake Reservoir and the very limited fishery in Thousand Springs downstream from the influence of Crittenden Creek could be significantly affected by a lack of water. The decreased water table would affect the relative abundance of fish species such as the Utah chub, northern pike and largemouth bass found in Dake Reservoir (Table 4-5 in the Ecological Resources Technical Report). Under extreme conditions, Dake Reservoir could be lowered below historic levels or emptied completely. Until the time when controlled releases could be reinstituted, the fishery in Dake Reservoir would be removed.

As stated in the proposed action, conversion of water uses on Winecup and Gamble ranches is an important component of the proposed water supply system for development beyond power plant Units 1 and 2. A consequence of this conversion of water use would be the elimination of hay production along Thousand Springs Creek. This action could improve grazing for wildlife by reducing competition for forage and habitat, if cattle were removed from the area. However, eliminating hay production does not necessarily mean that cattle would be removed from the ranches because hay could be purchased rather than produced. Livestock grazing of wetland/riparian habitats following curtailment of irrigation practices could result in further loss or conversion of these resources to less productive habitats. A decrease in the amount of available irrigated pasture or hay lands could increase grazing pressure in remaining riparian areas, possibly causing degradation of these resources, e.g., concentrated use of Thousand Springs Creek area could result in increased channel incision relative to flood plains. Eliminating irrigation of pasture and hay lands would necessitate changes in Lands of Sierra, Inc.'s livestock operations. These changes could include any or all of three options discussed in Section 5.12.1.2. Potential impacts to public lands as a result of these changes would be evaluated and mitigated through the BLM's allotment evaluation and monitoring program.

5.6.2 ALTERNATIVES

5.6.2.1 Alternative Access Roads

Moor Summit Access Road. This alternative road access exits I-80 at Moor Summit and continues 24 miles northeast to the plant site. This would all be new construction and, therefore, impacts to vegetation and wildlife would be greater than those identified for the proposed Wilkins access.

Fencing the alternative access road would interrupt a mule deer migration corridor near Moor Summit and Pequop Mountains. Approximately 6000 mule deer migrate through the Snake Mountains, Windermere Hills, Independence Valley, Toano Draw, and Pequop Mountains as they travel between their winter and summer ranges. About 4000 of these deer migrate south through the Pequop Mountains and Wood Hills, while the remaining 2000

migrate further east towards the Toano Range (J. Williams 1989). Information on road kills in the Pequop Mountain area is not well documented, but available data provide a relative comparison to the proposed access road. For example, mule deer crossing Highway 93 from the Snake Mountains (Figure 4.6-4) during the 1987-88 migrations resulted in less than 25 known deaths. In contrast, approximately 200 deer were killed as they crossed I-80 in the Pequop Mountain area. It should be noted that the actual number could be 3-4 times greater than these numbers, because deer that are hit but are not immediately killed may die after they have left the highway area (J. Williams 1989). Based on these data, a large percentage of this herd is eliminated each year by vehicle-animal collisions on I-80. With increased traffic along I-80 and additional traffic on the Moor Summit access route, mule deer deaths due to animal-vehicle collisions could increase significantly. Impacts to migrating mule deer would be significantly greater under the Moor Summit access road than under the proposed access road or the Brush Creek access road.

Brush Creek Access Road. This alternative access road begins at Route 93 about 3.5 miles south of Wilkins and proceeds in an easterly direction approximately 13.5 miles to the proposed plant site. Fencing this road would interrupt one mule deer migration corridor through Thousand Springs Creek. This newly created road system would have greater impacts to vegetation (sagebrush/upland) and wildlife than the proposed action. However, this alternative would have less impact than the Moor Summit Road. Impacts to migrating mule deer would be the same as the proposed action.

5.6.2.2 Alternative Construction-Worker Accommodations

The no construction-worker camp alternative would not provide worker accommodations at the plant site, thus forcing construction crews to find housing elsewhere. No further impacts than those listed for the proposed action are expected for vegetation. For wildlife there could be a slight decrease in hunting/trapping and fishing pressures, and poaching and shooting wildlife; however, these pressures may exist if workers were to camp on lands adjacent to the plant site. Impacts resulting from animal-vehicle collisions would most likely increase due to greater traffic between the plant site and worker residences.

5.6.2.3 Alternative Plant Water Supply

Alternative 1 has a larger potential to lower groundwater levels (by 15 to 20 feet) in areas along Thousand Springs Creek north of Toano Draw compared to the proposed action. This alternative could increase impacts to riparian vegetation (particularly shallow-rooted species) in the reach of stream between Winecup Ranch and Twentyone Mile Draw and would decrease the potential for reduction of discharge from springs at the south end of Toano Draw.

Alternative 2 would draw less water from Toano Draw; therefore, groundwater level drawdowns could be less in that area than with the proposed action. As discussed for the proposed action, no significant

impacts to riparian vegetation are expected between Winecup Ranch and Twentyone Mile Draw. With this alternative, it is likely that controlled release from Crittenden Reservoir would need to be increased because more water would be drawn from the Gamble Ranch wellfield.

5.6.2.4 Land Acquisition Alternatives

Right-of-Way Grants. This alternative would involve obtaining right-of-way permits from BLM to implement the project program. This alternative would eliminate public acquisition of private lands which would result in a net loss of habitat for vegetation and wildlife in public domain for the duration of the project.

Selling the Public Lands. According to this alternative, public lands would be sold by competitive bid. The environmental consequences would be similar to those addressed under the Right-of-Way Grants alternative but of a more permanent nature.

5.6.3 MITIGATION

5.6.3.1 Mitigation Measures for Construction of the Power Plant

Three categories of ecological resource mitigation measures are described here for construction effects, including planning, design and construction commitments, and other. The implementation of these measures is anticipated to minimize expected impacts to ecological resources and endangered species within the project area. These suggested mitigation measures include the following provisions:

- Planning
  - Conduct work in streams in a manner that minimizes erosion and siltation. Erosion control measures should consist of preparing slopes, replacing topsoil, applying fertilizer, seeding areas left barren after construction completion, and containing drainage on site during construction.
  - Identify raptor nests prior to construction.
  - Minimize disturbance to plant and wildlife species by minimizing soil (erosion) and tree (raptor roosts/nests) removals to the minimum extent necessary to construct the proposed project facilities. The exact amount of these disturbances is not presently known.
- Design and Construction Commitments
  - Establish formal design and construction criteria at the start of design to set forth requirements to minimize disturbance within and adjacent to the project area. These criteria should be based upon BLM requirements and guidance.
  - Utilize erosion controls during construction activities.

- Restrict off-road vehicle use by the construction workforce in the project vicinity.

- Prohibit unauthorized firearms in the TSPP area. Although this restriction is not enforceable, it should be TSGC's policy to restrict firearms within the construction-worker camp and power plant facilities. Workers failing to comply with this restriction could risk termination.

- Revegetate with BLM-approved species, as appropriate, to facilitate soil stabilization and to speed recovery of lost vegetation.

- Employ dust control measures, including the regular application of water to minimize dust emissions created during construction. Water should be applied at locations by means of pressure-type sprayers designed to insure a uniform application of water. Dust palliatives should not be used unless site-specific evaluations indicate that they would be more effective control measures.

- Do not locate construction lay-down areas (i.e., the assembly areas for construction materials, components, and equipment) near stream crossings in riparian or other sensitive habitats.

- Restrict vehicle maintenance activities to areas away from stream banks.

- Stockpile, replace, and restore top soil to disturbed areas following BLM procedures.

- Do not fence access or railroad to avoid fence entanglements by big game.

- If fences are constructed, let down fences should be installed in key areas. Construct fences a minimum of 300 feet either side of centerline in key migration areas to minimize animal-vehicle collisions and entanglements by big game.

- Realign the proposed access road, wellfield power line, and water supply pipeline, as may be necessary, in the area of known sage grouse strutting grounds, to avoid affecting breeding locations.

- Reduce the number of animal-vehicle collisions by posting speed limits along access roads (50 miles per hour).

- Bus workers to and from the plant site to reduce the occurrence of animal-vehicle collisons.

- Reduce the impact of wellfield powerlines across sage grouse leks by making them perch-proof and/or by burying them underground to reduce predation by raptors.

- Implement time-of-year restriction for construction of ancillary facilities.

• Other Measures
- Designate a site representative to act as liaison with the BLM for compliance with regulations and stipulations.

- Have a BLM biologist/botanist act as an advisor to provide direct on-site input to ensure the contractor's compliance with mitigation stipulation in biologically sensitive areas.

- Include within the worker orientation program a session which addresses environmental awareness and outdoor safety.

5.6.3.2 Mitigation Measures for Operation of the Power Plant

Significant long-term impacts to the marsh complex near Dake Reservoir would require mitigation. A system of shallow monitoring wells should be established as part of the overall groundwater monitoring program. Baseline monitoring of groundwater levels should be conducted prior to operation of the proposed facility to assess natural fluctuations. Monitoring should be continued throughout the operation of the proposed facility to discern potential impacts to groundwater level and to wetland/riparian habitats.

If groundwater and vegetative monitoring show loss or conversion of jurisdictional wetlands to less productive types, impacts could be mitigated through reestablishment of wetland/riparian habitats similar to those affected. The potential for creation of wetland/riparian habitats varies as a function of the amount of water available, the degree to which a stream channel is incised relative to floodplains and the permeability of the substrate. The areas of highest potential for creation of wetland/riparian habitats are those with stream channels that are not incised (graded) and with fine-textured substrate with low permeability. Where the valley bottom is flanked by residual lands, stream channels are usually incised and substrates are relatively coarse textured with moderate to high permeability, resulting in a low potential for creation of wetland/riparian habitat. Where the valley-bottom is flanked by alluvial lands, substrates are somewhat finer with moderate to low permeability, resulting in a moderate potential for creation of wetland/riparian habitat. Where the valley bottom is flanked by lacustrine lands, substrates are fine with low permeability, resulting in a high potential for creating wetland/riparian habitat.

Depending on the level of impacts to wetland/riparian areas and aquatic resources, several mitigation options could be implemented. Mitigation measures may include any and/or all of the following:

- Continue to irrigate selected haylands and/or pasturelands

- Reclaim drained wetlands.

- Construct enclosures around wetland/riparian habitats containing shallow groundwater monitoring wells to create a "control" that would protect the stream channel from livestock use and measure changes in wetland/riparian habitat in response to changes in water table level as a result of project operation.

- Eliminate cattle use on all or selected areas of converted wetland habitats.

- Continue historical cattle use on wetland/riparian habitats (i.e., fall use only).

- Reseed fallow croplands to native species.

- Monitor shallow groundwater of Dake Reservoir.

- Fence wetlands at Dake Reservoir to exclude livestock use.

- The quantity of controlled releases from Twentyone Mile and Crittenden Reservoirs should be negotiated between the applicant, NDOW and BLM. Agreements should be developed to consider the merits of controlled release versus minimum release.

- Monitor impacts to birds from exposure to wastewater ponds and initiate appropriate mitigation as necessary. Mitigation could include the use of hazing devices, installing netting over the ponds, or other appropriate preventative measures authorized in cooperation with the Nevada Department of Wildlife.

5.7 CULTURAL RESOURCES

Results of the initial literature review and site survey file search indicate that the study area possesses a rich archaeological record spanning 12,000 years of history and prehistory. The proposed project would have varying effects on these resources, including transfer of archaeological and historical sites from Federal ownership, destruction or damage of sites by construction activities, general deterioration or destruction of the sites due to increased human activity in the region, and effects to site settings.

Among these potential effects are impacts to areas of historical importance to Native Americans. As a result of the Native American consultation effort, some people were identified who still have memories of traditional activities in the project area. Some tribal councils and individuals expressed general concerns about protection of graves and

sacred places, and about the need to protect traditionally hunted animals and traditionally gathered plants and to provide continued access to hunting and gathering areas. The Western Shoshone Elders Council called a meeting to explain their concerns, and were joined by representatives of most of the Shoshone tribal groups and political organizations. Their primary concern was the issue of title to traditional Western Shoshone territory. They contend that BLM-administered lands in the project area are Western Shoshone lands and that, therefore, the BLM has no authority over those lands. They declined to discuss specific concerns about graves, sacred places, hunting and gathering areas, or other issues that might be affected by the project.

The following discussion of project impacts is based on incomplete inventory data and must be considered tentative. Potential impacts are discussed with regard to related project features. Additional information is contained in the Cultural Resources Technical Report.

5.7.1 PROPOSED ACTION

5.7.1.1 Land Acquisition

Fieldwork for all of the selected land involved in the exchange and much of the land for proposed rights-of-way has been completed, but the report for the most recent inventory (6980 acres) is in progress and insufficient information is available to address the significance of the last 220 sites recorded or to determine the effect of the project on these sites. Of the sites previously inventoried and evaluated, the seven sites thought to be potentially eligible would no longer be under Federal control with the proposed action.

5.7.1.2 Construction and Operation

Cultural resource inventories are at various stages of completion, and definitive statements about potential effects cannot be made at this time. Fieldwork is mostly complete for the railroad and access road but no inventory has been done for the proposed water lines and wellfields and the proposed plant location is only partially inventoried. The report for the railroad and access road inventories is in progress; findings will be reported fully in the final EIS. Inventory of the rest of the power plant lands and the water lines will be completed in the near future.

Construction and operation of the power plant has the potential to impact numerous cultural resources including both those at the plant site and those located in the surrounding area. Anticipated effects at the plant site would primarily be partial or complete destruction of archaeological sites that cannot be avoided by project facility relocation. Potential effects to cultural resources in the surrounding area include introduction of visual or audible elements that are out of character with the setting of the historic properties, increasing recreational and other human activity in the area with the resultant damage to cultural resources, drying of springs which may contain cultural resources, and damage or destruction of sites by construction of associated linear facilities.

Modification of setting by the proposed action has the potential to effect the California Emigrant Trail, the Winecup Ranch, and the antelope traps. Analysis specific to visual and audible effects has not yet been done but will be included as a part of the Historic Property Identification Plan. The power plant will be visible from segments of the Emigrant Trail, at a distance of 6 to 8 miles, and possibly from the Winecup Ranch and part of the antelope trap complex.

Importation of the labor force necessary to construct and operate the power plant would have considerable impact to cultural resources in the region. With the inmigration of a workforce, an increase in illegal excavation, vandalism, and artifact collection at cultural properties is expected, as is inadvertent damage from legitimate activities such as off-road vehicle use and the various activities associated with construction of housing and support facilities for the workers in and near the various communities.

The greatest impact is expected in the vicinity of the power plant since as many as 520 people would be living in the construction-worker camp at the plant site. Because the camp will be in use for approximately 20 years and recreational activities will be limited, considerable recreational use of the surrounding area is expected. Any cultural property in the vicinity could be impacted. The antelope trap complex in particular would undoubtedly be affected due to its high visibility and proximity to the plant site.

Native Americans have expressed concern that the construction-worker camp alternative would increase the likelihood that grave sites, sacred places, and other areas of traditional importance might be vandalized, desecrated, or otherwise affected.

In order to better understand the cultural resource data base in Toano Draw so as to be able to devise a means of lessening impacts to cultural resources, a Class II (sample) archaeological inventory will be conducted in those parts of the valley where data are lacking.

Impacts from plant operation may include the potential loss of paleoenvironmental and/or archaeological/paleontological data if springs and/or meadows become dry due to groundwater withdrawal. Organic material and pollen, not ordinarily preserved, may be present in the saturated soils of wetlands and would decay if water is removed.

The preferred access to the project would require paving of an existing gravel county road and construction of 10 miles of new road. New construction would cross an area of high prehistoric site density. Upgrading would occur on a portion of the county road where it parallels or overlies the route of the California Emigrant Trail, and where it passes near the Winecup Ranch. Impacts have not been analyzed at this time, but according to maps supplied by the Oregon-California Trails Association, no

actual remains of the trail occur at this location. A pristine segment of trail is found approximately ½ mile northeast of the point where the new construction will join the existing road.

Information on the number and type of sites located along the proposed railroad route is not available at this time. Historic railroad camps could be located where the new grade is to tie into the existing Southern Pacific tracks.

A cultural resource inventory of the proposed water pipelines has not been done yet so effects cannot be assessed at this time.

5.7.2 ALTERNATIVES

5.7.2.1 Alternative Access Road Corridors

Moor Summit Alternative Road Access. Portions of the alternative access road appear to route through areas of greater prehistoric use as evidenced by increased site densities recorded during the recent Class III inventory. The actual consequences will be determined following the Historic Properties Identification Plan described in Section 5.7.3. The Moor Summit access road also parallels the now abandoned right-of-way of the Central Pacific Railroad, segments of which are listed on the National Register of Historic Places.

The initial alignment of the Central Pacific Railroad, completed in 1869, remained in use until 1903 when the line was upgraded and in some places realigned. One area of major realignment occurred between Moor Summit and Toano, and as a result, major sections of the original grade remain. For much of its length, the proposed Moor Summit access road is located on or adjacent to this original grade. Effects likely to occur are the obliteration of railroad grade bed sections and associated features, such as culverts, trestles, camps occupied during grade construction, and associated artifact scatters. Introduction of a travelled roadway in the vicinity also would have an effect on the setting of the resource. Parts of the abandoned highway, State Route 1, would be obliterated by the Moor Summit route.

Brush Creek Alternative Access Road. Adoption of this alternative route would reduce potential consequences to cultural resources as it avoids the Winecup Ranch area, Central Pacific Railroad, State Route 1, and areas of high prehistoric site density. This alternative parallels and crosses the route of the Emigrant Trail; however, no evidence of the trail or associated artifacts are found in the area of the crossing.

5.7.2.2 Alternative Construction-Work Accommodations

No Construction-Worker Camp. Adoption of this alternative would require the workforce to establish housing in communities outside the study area. This alternative could minimize the potential for impacts to historic properties in the study area from both inadvertent damage related to recreation and from purposeful illegal collecting. However, it could

result in an equal amount of damage to cultural resources in other areas where there is a population increase. All other consequences are expected to remain the same as those discussed in Section 5.7.1.2.

5.7.2.3 Alternative Plant Water Supply

Field locations for water supply alternatives have not been completed. Inventory and evaluation consistent with the HPIP would be completed if the alternative were adopted and the location identified.

5.7.2.4 Land Acquisition Alternatives

Right-of-Way Grants. Adoption of this alternative would result in similar consequences to cultural resources as discussed with regard to the proposed action. However, efforts to inventory historic properties would be limited to areas of project effects, rather than a comprehensive survey of the selected lands. Additionally, the private lands offered for exchange would remain private property and would be treated accordingly under National Historic Preservation Act.

Selling the Public Lands. Adoption of this alternative would result in similar consequences to cultural resources as discussed with regard to the proposed action, with the exception of the private lands offered for exchange, which would remain private property and would be treated accordingly under NHPA.

5.7.3 MITIGATION

As previously discussed, only parts of the proposed project area have been inventoried for cultural resources. To satisfy its responsibilities under Section 106 of the NHPA, the BLM would ensure that all areas of direct impact will be inventoried to a Class III level, and that surrounding lands in Toano Draw, which would be subject to indirect impacts, would be inventoried at a Class II (sample) level prior to transferring any land, authorizing any right-of-way, or authorizing any Notice to Proceed. Figure 5.7-1 depicts the cultural resource compliance process.

A Historic Properties Identification Plan will be prepared to provide direction for the identification and evaluation effort. The Historic Properties Identification Plan will be prepared by the applicant, under the direction of the BLM, and would be responsive to guidance provided in the following:

- The Secretary of Interior's Standards and Guidelines for Identification and Evaluation (48 FR 44719-26)
- The Secretary of Interior's Standards and Guidelines for Archeological Documentation (48 FR 44734-37)
- Treatment of Archeological Properties (Advisory Council on Historic Preservation 1980)

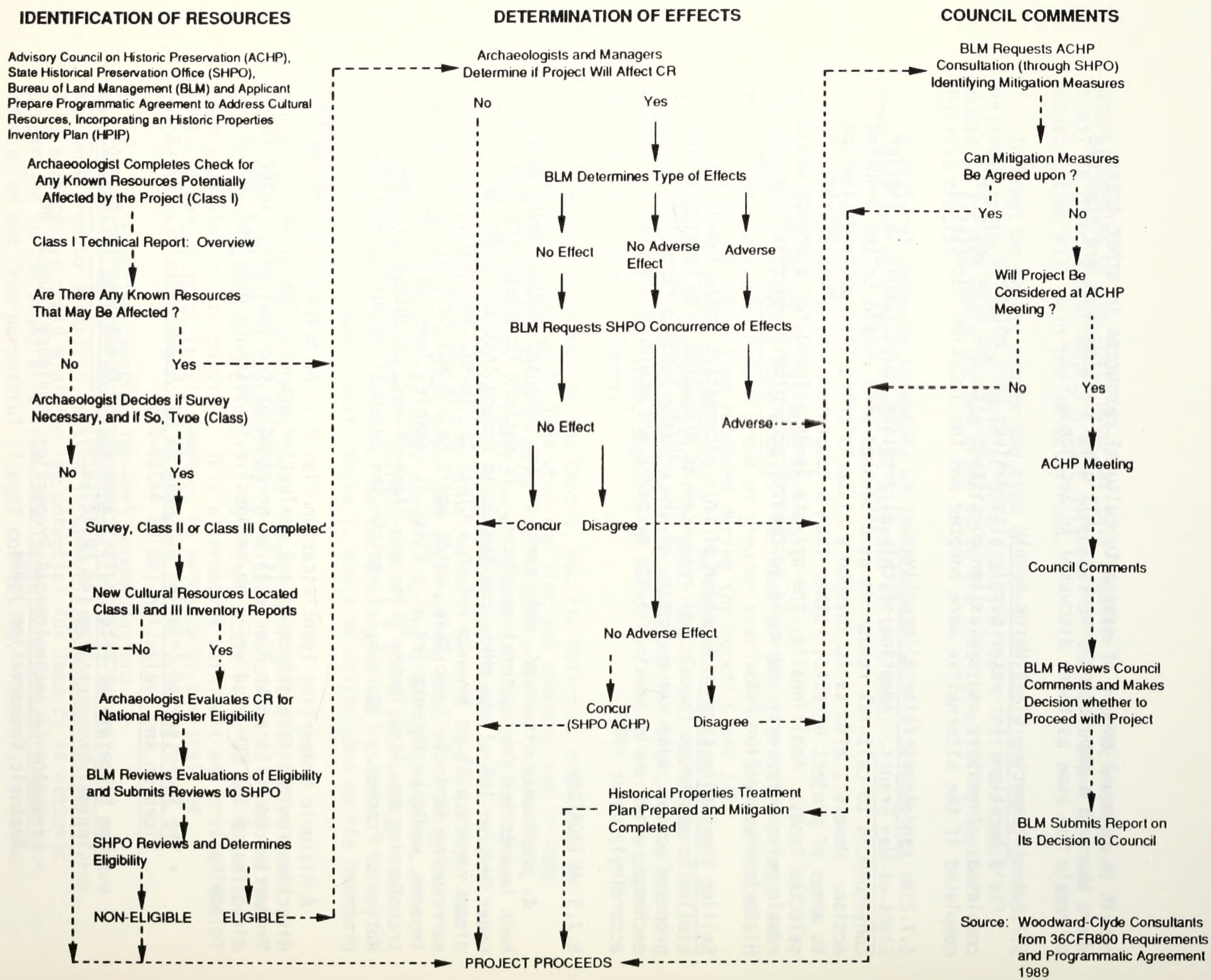


Figure 5.7-1. SECTION 106 CULTURAL RESOURCE COMPLIANCE PROCESS

- <u>The Nevada Historic Preservation Plan</u>
- <u>36 CFR Part 60: National Register of Historic Places</u>
- <u>36 CFR Part 63: Determinations of Eligibility for Inclusion in the National Register of Historic Places</u>

The Historic Properties Identification Plan would include methods to identify sites or areas of traditional and sacred value to Native American groups, and mechanisms to ensure that the views of interested Native American groups are considered in project planning.

The BLM would evaluate all properties identified through the implementation of the Historic Properties Identification Plan in accordance with 36 CFR 800.4(c) and would submit a report of the results of the plan's implementation to the SHPO for review. The SHPO would provide comments on these results and findings within 30 days of receipt.

If implementation of the Historic Properties Identification Plan results in the identification of properties that are eligible for the National Register, the BLM would ensure that they are treated in accordance with the Historic Properties Treatment Plan discussed below.

The BLM would ensure that an Historic Properties Treatment Plan is developed based on the results of the implemented Historic Properties Identification Plan to address the effects of the proposed project on historic properties. The plan would identify all historic properties located within the Area of Potential Effect, the nature of the effects to which each property would be subjected, and the treatment strategies proposed to minimize or mitigate the effects of the project. Properties eligible for the National Register, based on Criterion D, the potential to yield data, will be addressed with recommendations for data recovery. Properties eligible for other reasons (i.e., history or architecture) will be treated with mitigative measures consistent with property value, i.e., Historic American Building Survey/Historic American Engineering Record recording for architecture, and/or historic documentation for sites of historic significance. The BLM would submit the Historic Properties Treatment Plan to the SHPO and Advisory Council on Historic Preservation (ACHP) for review. The SHPO and ACHP would comment on the plan within 30 days of receipt. If the SHPO and ACHP do not submit their comments within 30 days of receipt, the BLM would implement the plan. If either the SHPO or ACHP object to all or part of the Historic Properties Treatment Plan, the BLM would consult with the objecting party to resolve the objection.

Some of the options that will be considered to mitigate or lessen effects to historic properties are discussed below. Options for sites that would be affected by the land exchange or project construction include deletion of lands with significant properties from the exchange, avoidance of sites through project modification, intense mapping and recordation of

sites, or excavation of archaeological sites. Options for sites that could be impacted due to an increased human presence are preparation of educational programs on cultural resource preservation for project employees, patrolling and monitoring of site condition, development of interpretive trails and/or signs at the antelope trap complex and Central Pacific railroad grade, excavation of archaeological sites, and intensive mapping and recordation of sites.

Springs with potential to contain paleoenvironmental information and/or organic cultural resources which might go dry due to lowering of water tables would be monitored. Those which go dry would be tested by the proponent to determine if the anticipated resources are present. If significant resources are present, treatment consistent with that for data recovery projects discussed below would be implemented by the proponent.

Where the BLM determines that data recovery is the preferred management option, the BLM would ensure that a data recovery plan, based on a research design is developed in consultation with the SHPO for the recovery of archaeological data. Data recovery plans would be consistent with the guidelines noted in Section 5.7.2.4 and would specify at a minimum:

- The property, properties, or portions of properties where data recovery is to be carried out
- Any property, properties, or portions of properties that would be destroyed, altered, or transferred without data recovery
- The research questions to be addressed through the data recovery, with an explanation of their relevance and importance
- The methods to be used, with an explanation of their relevance to the research questions
- The methods to be used in analysis, data management, and dissemination of data, including a schedule
- The proposed disposition of recovered materials and records including the disposition of Native American sacred items, human remains, and grave goods
- Proposed methods for involving the interested public in data recovery
- Proposed methods for disseminating results of the work to the interested public
- Proposed methods by which relevant Native American groups and local governments would be kept informed of the work and afforded an opportunity to participate

- A proposed schedule for the submission of progress reports to the SHPO, ACHP, and others

Data recovery plans would be submitted by the BLM to the SHPO and ACHP for review. Unless the SHPO or ACHP object after receipt of the plans, the BLM would ensure that they are implemented.

The BLM would ensure that all records and materials resulting from identification and data recovery efforts are preserved and stored in accordance with 36 CFR Part 79, provided that all materials to be returned to their owners would be maintained in accordance with 36 CFR Part 79 until their analysis is complete and they are returned.

5.8 PALEONTOLOGICAL RESOURCES

5.8.1 PROPOSED ACTION

5.8.1.1 Land Acquisition

No previously recorded significant paleontological resources exist in either the selected or offered lands. Minor occurrences of regionally common fossils exist in the Paleozoic and Mesozoic sediments underlying the mountain ranges. The selected and offered lands generally lie in areas away from the mountain ranges and thus would not affect these resources.

5.8.1.2 Construction and Operation

No previously recorded significant paleontological resources are known in the area proposed for project construction. Minor occurrences of regionally common fossils exist in the Paleozoic and Mesozoic sediments. Construction of the proposed power plant facilities, the proposed access road, coal transportation corridor, transmission lines, wellfields, and water supply pipelines would be primarily confined to the alluvial sediments and would not affect regionally common fossils. However, vertebrate fossils of unknown paleontological significance were recently found in Tertiary to Quaternary alluvial deposits in the vicinity of the Winecup Ranch.

The paleontological significance including the identification, age, and extent of this resource, as well as its location relative to construction and operation activities, will be assessed prior to construction of the proposed power plant and ancillary facilities.

5.8.2 ALTERNATIVES

None of the alternatives (i.e., access roads, construction-worker accommodations, water supply, land acquisition, or no project alternative) would involve impacts different from the proposed action.

5.8.3 MITIGATION

Studies of the vertebrate fossils found in the vicinity of the Winecup Ranch will be conducted to assess their significance. Depending on the findings of this study, mitigation measures may be necessary to protect this resource.

No mitigation measures for paleontological resources are recommended at this time, due to an incomplete inventory.

5.9 VISUAL RESOURCES

The assessment of visual impacts was based upon impact significance criteria and methodology established by the BLM in their visual contrast rating system. Impacts to visual resources were assessed for the land exchange, construction, and operation of the proposed project. Quality of the visual environment is defined by BLM Visual Resource Management (VRM) classes. Two issues were addressed in determining impact significance: the type and extent of actual physical contrast resulting from the proposed action and alternatives, and the level of visibility of a facility structure or a given corridor segment. Impacts are considered significant if significant visual contrasts are identified for landscape modifications affecting the following: the quality of any scenic resources; scenic resources having rare or unique value; views from, or the visual setting of, designated or planned parks, wilderness, natural areas, or other visually sensitive land use; views from, or the visual setting of, travel routes; and views from, or the visual setting of, established, designated, or planned recreational, educational, preservational, or scientific facility, use area, activity, and viewpoint or vista.

The extent to which the proposed project would adversely affect visual quality depends upon the amount of visual contrast created between the proposed facilities and the existing landscape elements and features (land and water surface, vegetation, and structures). The magnitude of change relates to the contrast between each of the basic elements (form, line, color, and texture) and each of the features. Assessing the project's contrast in this manner indicates the severity of potential impacts and guides the development of mitigation measures to reduce the contrast to the point where the requirements of the VRM classes would be met.

Levels of impacts were based upon the VRM classification of lands for the land acquisition, construction, and operation by the proposed action and by each alternative. Potentially high impacts would occur in distinctive scenic areas and Class II lands, moderate-to-high impacts on Class III lands, and generally low impacts on Class IV lands.

5.9.1 PROPOSED ACTION

5.9.1.1 Land Acquisition

Effects of visual resources brought about by the proposed land exchange would result in a net loss of approximately 80 acres of Federal BLM VRM Class II and 1500 acres of Class III lands. All parcels of private lands to be exchanged are classified as VRM Class IV lands. The net loss is not considered significant. Although the non-Federal parcels of the Snake Range are classified as VRM Class IV lands, they are considered to have higher levels of scenic quality than the BLM parcels located at the TSPP site. Even though a loss of higher BLM VRM class lands would occur, the net increase of lands of higher scenic quality (the Snake Range lands) would provide an overall positive effect to visual resources.

5.9.1.2 Construction

Landscape modifications from construction of the proposed project would be within the BLM VRM Class IV objectives and thus would not significantly affect visual resources. The plant site is located on VRM Class IV lands, where structures are allowed to dominate the landscape. The plant site would have a blocky silhouette and vertical line contrast with protective stack lighting which would be visible in the background distance zone. Flashing strobe lights would be visible from the top of stacks for several miles. This would attract visual attention during the nights but would not create significant effects. Figure 5.9-1 is a photographic simulation of TSPP. The photographic simulation is the view from the main Toano Draw road, 5 miles southeast of the Winecup Ranch. The viewing distance is approximately 2 miles. The ancillary facilities (access road, railroad spur, wellfield, wastewater and solid waste disposal and water pipeline) would be located primarily on Class IV lands. These facilities would be less dominant and less noticeable than the plant site. These facilities would create low to moderate horizontal line and color contrasts. The Jarbidge and East Humboldt Wilderness Areas would not receive any significant visual effects brought about by the project.

5.9.1.3 Operation

The visual effects for the proposed action described for the construction phase would continue during operation. The visual effects of the aircraft warning lights on the emission stacks are unknown but thought to be minimal. No additional visual impacts would occur.

In the year 2045, following the anticipated closure, if no reclamation plan were implemented, the effects described under construction (Section 5.9.1.2) would continue.

5.9.2 ALTERNATIVES

5.9.2.1 Alternative Access Road Corridors

The Moor Summit access road would be located on an existing road. Additional cuts and fill which could be required to improve the road would not significantly increase visual impacts which are seen from the 1.5-mile low-visibility corridor that parallels I-80.

The Brush Creek access road alternative would have the same impacts as the proposed Wilkins road.

5.9.2.2 Alternative Construction-Worker Accommodations

Not building the construction-worker camp would reduce the number of structures at the plant site, thus reducing the size and visual impacts associated with the plant.

5.9.2.3 Land Acquisition Alternatives

The alternatives of ROW grants and selling of public land would not affect visual resources or VRM class IV lands at the project site.

5.9.3 MITIGATION

For reducing significant visual contrast, there are two generic types of mitigation techniques: minimization of disturbance, and facility design with consideration given to repetition of the basic landscape elements (form, line, color, texture). Unless a specific facility is identified, the appropriate selection of mitigation recommendations listed below would effectively reduce visual contrasts for most types of the proposed project facilities.

- Minimization of Disturbance

1. During construction, clearing of land for project facilities or structures should create curvilinear boundaries instead of straight lines and minimize disturbance of the landscape (BLM 1982). Grading should be done in a manner which would minimize erosion and conform to the natural topography (USFS 1977).

2. The clearing of vegetation for the project facilities should be limited to the minimum area required. Feather and thin edges of vegetation.

3. To the extent possible, all foliage adjacent to the site should remain undisturbed to provide maximum available screening of the installation relative to the landscape character type.

4. Soil which has been excavated during construction and not used should be evenly backfilled into the cleared area. The soil should be graded to conform with the terrain and the adjacent land.

5. Dumping of excess material or material on downhill slopes should be minimized.

6. Replacement of earth adjacent to water crossings should be at slopes less than the normal angle of repose for the soil type involved.

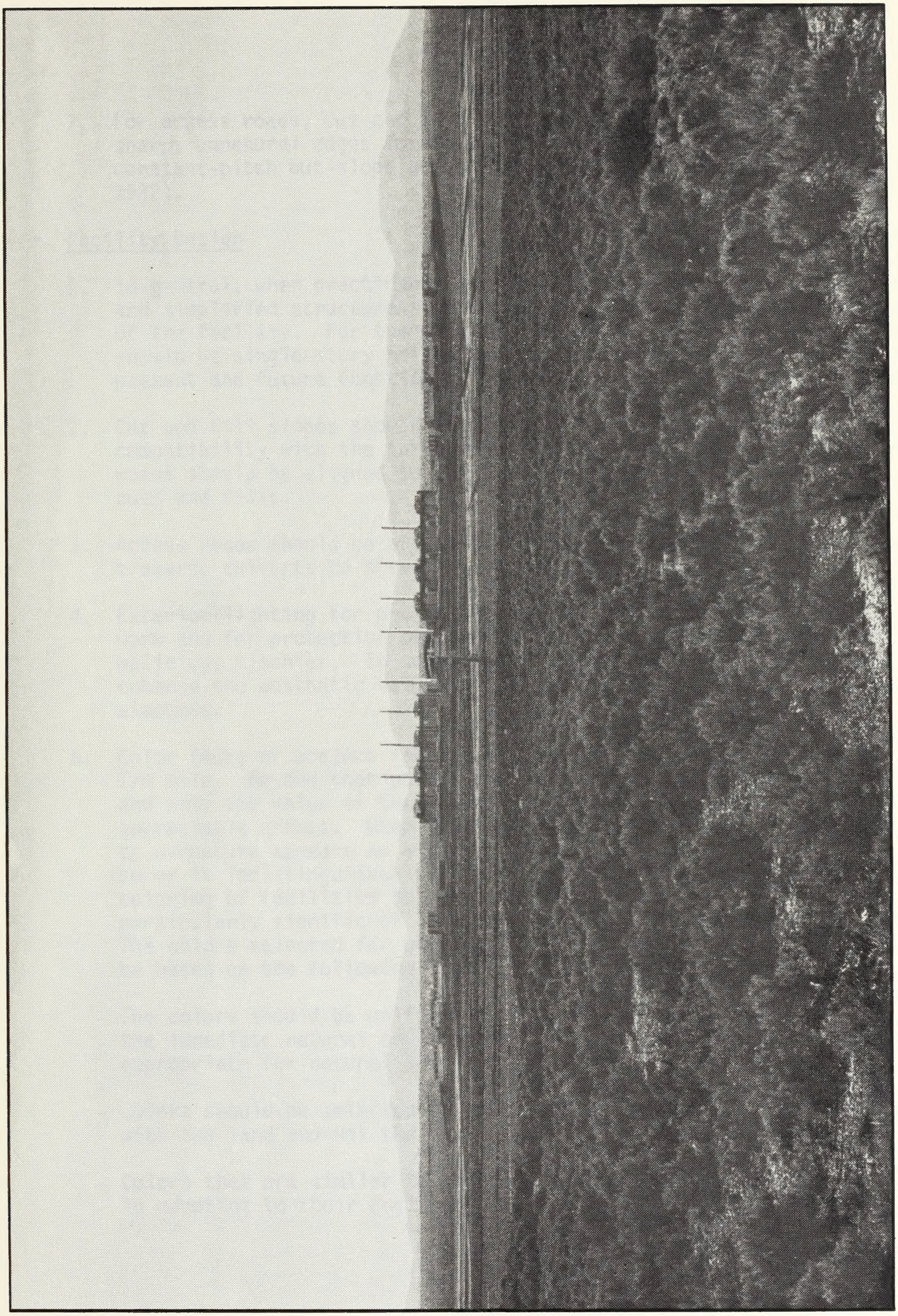


Figure 5.9-1. PHOTOGRAPHIC SIMULATION OF THE THOUSAND SPRINGS POWER PLANT

7. For access roads, cut and fill slopes should be rounded to break sharp, unnatural edges formed at the contact point between the constant-pitch out-slope and the rounded natural landform (BLM 1982).

• Facility Design

1. In general, when practicable, the use of low-profile concepts and simplified structures would enhance the overall appearance of the facility. For the construction-worker camp, structures should be single-story height and of minimum size to satisfy present and future functional requirements.

2. Cut and fill slopes should be designed to achieve maximum compatibility with the surrounding natural topography. Access roads should be aligned to follow existing grades to minimize cuts and fills.

3. Access roads should be provided with side drainage ditches and traverse culverts to prevent soil or road erosion.

4. Exterior lighting for project facilities should be adequate for work and for protection of the facilities from sabotage and malicious mischief. In some cases, exterior lighting may enhance the aesthetic values of the structured landscape elements.

5. Color (hue) of project facilities is most effective within about 1/4 mile. Beyond that point, the hue becomes indistinguishable and only the value of the color can be expected to have any appreciable effect. When viewed from the shaded side, a facility structure appears as a dark silhouette and generally its color is indistinguishable. Consideration should be given to coloring of facilities to blend with the landscape. This is particularly significant in or near areas of high scenic value. The colors selected for project facilities and structures should be based on the following considerations (Robinette 1973):

   - The colors should be uniform and noncontrasting to blend with the immediate natural environment. The warmest color tones are appropriate for natural settings.

   - Colors should be selected on the basis of their ability to blend with the land and not the sky.

   - Colors that are similar to adjacent colors are most successful in adapting to their environment.

- Select paint finishes with low levels of reflectivity (i.e., flat or semi-gloss).

5.10 RECREATIONAL RESOURCES

The project would affect recreational resources, both directly (primary impacts) by physical changes to resources, and indirectly (secondary impacts), by visual or use (secondary) influence. Primary impacts would occur if construction or operation of the TSPP project resulted in the termination of use or modification to recreational resources within the 100-mile-radius study area. Secondary impacts would result if construction and operation activities altered recreation use patterns or recreation demand and access to use areas near the proposed project.

Four impact criteria were identified for recreational resources. These included project-related changes that would:

- Alter or otherwise physically affect established, designated, or planned recreational use areas or activities
- Affect officially adopted policies or goals for recreational land management of recognized organizations, or agencies
- Increase or decrease accessibility to areas established, designated, or planned for recreational use
- Affect the duration, quantity, and quality of impact to recreational resources

Based on these criteria, several areas of significant direct impact to recreational resources would result from the TSPP project during construction and operation (Table 5.10-1).

5.10.1 PROPOSED ACTION

5.10.1.1 Land Acquisition

Positive public benefits and effects would result from the exchange of offered lands in the Snake Mountain Range for selected lands located at Toano Draw. The Snake Mountain range contains better wildlife habitat to support larger populations of game animals for seasonal hunting, camping, and sightseeing.

The Snake Mountain Range would incorporate a block of contiguous sections adjacent to BLM land. Lands available for recreational opportunities under BLM management would increase for hiking, camping, hunting, and scenic views.

5.10.1.2 Construction

Due to the long duration (20 years) of the construction period, all impacts would be long-term (greater than 5 years).

Table 5.10-1. RECREATIONAL IMPACTS OF PEAK TOTAL WORKFORCE FOR CONSTRUCTION AND OPERATION

	High	Moderate	Low	Current Status
Ruby Marsh Campground		O	C	The campground receives very heavy use, particularly July-October. Use is at capacity.
Tabor Creek	O,C			Use is near capacity.
Salmon Falls Creek		O	C	Use is below capacity.
Crittenden Reservoir	O,C			Could be affected by land exchange by providing better access. Use is below capacity.
Mary's River			O,C	Use is below capacity.
Bishop Creek Reservoir	O,C			Reservoir is now dry, fishing in creek only
Texas and Opal Springs			O,C	Use is below capacity.
Dake Reservoir			O,C	Use is below capacity.
Boies Reservoir			O,C	Use is below capacity.
Angel Lake	O,C			Nearest alpine recreational setting. Fishing is at capacity, and camping below capacity.
Angel Creek	O,C			Nearest alpine recreational campground. Use is below capacity.
Wildhorse Crossing			O,C	Use is below capacity.
Wildhorse Recreation Site		O	C	Demand would increase for water skiing and power boating although proposed South Fork Reservoir would provide additional water-oriented recreational acres. Current use is below capacity.
Big Bend			O,C	Use is below capacity.
Pine Creek			O,C	Use is below capacity.
Jarbidge			O,C	Use is below capacity.
Ruby Crest Trail			O,C	Use is below capacity.

Table 5.10-1. RECREATIONAL IMPACTS OF PEAK TOTAL WORKFORCE FOR CONSTRUCTION AND OPERATION (concluded)

	High	Moderate	Low	Current Status
Ruby Mountain Scenic Area			0,C	Use is near capacity.
Roads End			0,C	Use is over capacity.
South Fork Reservoir			0,C	Use is below capacity.
Terraces			0,C	Use is at capacity.
Power House			0,C	Use is at capacity.
Thomas Canyon			0,C	Use is at capacity.
Ruby, Independent, and Jarbidge Mountains		0	C	Residents would undergo increased competition for a limited number of deer hunting tags
Ruby Lake National Wildlife Refuge		0	C	Use is below capacity.
Badlands WSA			0,C	Use is below capacity.
Jarbidge Wilderness Area		0	C	Use is below capacity.
Community of Wells	0,C			Present ratio of population to parkland cannot be maintained. Use is near capacity.
Community of Elko[a]	0,C[b]	0[c],C[c]		Greater pressure would occur on recreational facilities and parks with the no construction-worker camp alternative than from the proposed action for construction phase. Use is at capacity.

Note: 0 = Operation Workforce   C = Construction Workforce

[a] High impacts would occur for operation.
[b] No construction-worker camp alternative - Construction
[c] Proposed action - Construction

Source: Bureau of Land Management

The influx of people into the area as a result of the proposed action would affect community and developed recreational sites. Overcrowding of nearby developed recreational facilities (campgrounds, picnic, and fishing areas) could cause deterioration of physical improvements and environments (vegetation, soils, water quality) and thereby change the quality of recreational experiences. Table 5.10-1 summarizes impacts to recreational resources. Existing developed recreational site facilities operated by Federal, state, and local governmental agencies would be most affected. Attempts are being made to accommodate increased recreational needs within existing budgets and personnel.

Impacts to Fishing and Hunting Recreational Resources. In general, an increase in fishing pressure would occur at nearby reservoirs and streams. The areas of Crittenden Reservoir, Angel Lake, Bishop Creek Reservoir (although now dry), Bishop Creek, Angel Creek, and Tabor Creek would receive heavier visitor use because they would be in close proximity and easily accessible to the project site. Additionally, the relatively small sizes of these water bodies would be unable to sustain large populations of recreation for any extended periods of time. As pointed out in Table 4.10-2, the ratio in Elko County for number of miles of fishing streams needed by the year 2000 versus the number of existing fishing streams available would increase 25 percent to a deficiency of 8:1 from the present deficiency of approximately 6:1. An average construction workforce of 500 workers and their families would increase the population of the county by approximately 650 persons (2.6 percent increase) and would drive this ratio upward, creating a higher proportion of anglers to available miles of fishing streams.

Increased use of fishing resources would necessitate increased stocking of game species in order to maintain the present catch rate. Anglers would travel further to satisfy their expected quality of recreation experience if stocking is not increased.

An increased population would place moderate effects on the hunters of Elko County. Although NDOW regulates the number of hunting tags available from year to year for game species (mule deer, antelope, elk, etc.), the project construction population would probably decrease the chances for drawing a tag for a particular hunting unit. A local resident might not draw a tag to hunt in the same traditional location as before. Although data on poaching of game species are not easy to attain, the construction population could lead to increased poaching activity (this issue is addressed in Sections 5.6.1.2 and 5.6.1.3).

Impacts To Recreational Sites. In 1987, many of the recreational sites located in the study area were being used below or near capacity (Nevada Department of Conservation and Natural Resources 1987). Data from 1989 show that use of the recreational sites in and around the project site has increased. An additional 56,896 annual visitor-hours for recreational use on publicly managed sites would be anticipated as a result of project-

related population increases. This assumes the general availability of recreation areas and facilities is from May 15 through October 30. Criteria and assumptions used to calculate annual visitor hours are shown in Table 5.10-2.

Recreational facilities and parklands in the communities of Wells, Elko, and Jackpot would receive moderate impacts. Twin Falls would receive low impacts. At peak construction, in 1993, Wells is estimated to receive approximately 22 people or about a 2 percent population increase as a direct or indirect result of the project. The community would lack 3.7 acres of open space, as a result of the population increase, if it maintains the present ratio of open space and parkland to population. For Elko, assuming a population increase of 139 at peak construction in 1993, an additional 3.6 acres of parkland and open space would be required. Assuming a population increase of 18 in Jackpot, 2.7 acres of parkland would be needed. For Twin Falls, an additional 54.1 acres would be required with a population increase of 269 at peak construction.

It should be noted that the predicted need for additional open space and parkland acreage identified for recreational impacts was based on an assumption of maintaining the present ratio of population to acres of open space and parkland within the communities. The quantified increased pressure for use of these resources is not considered a significant impact because of the rural nature of the project area, which provides vast open space areas outside of the community borders. There are also additional recreational resources outside of the developed communities which are available for use; these resources are discussed in Section 4.10.3. The availability of these regional open space and recreational resources would tend to buffer the impact of increased use of the recreational areas within the communities.

Increased usage and crowding of facilities within and around town areas would cause changes in the public recreational experiences, which could eliminate some traditional uses of recreation sites, picnic areas, and parks (e.g., Fourth of July gatherings, annual family barbeques, etc.). Overcrowding could also result in limitations on public use of facilities and in increased maintenance and operational costs.

<u>Indirect and Secondary Recreational Impacts</u>. Increased use of nearby recreation areas areas would likely cause physical degradation in terms of loss of vegetation, increased erosion and general misuse of facilities, and littering within and around recreation sites. These impacts would be considered significant.

Secondary impacts in the form of authorized and unauthorized ORV use by construction workers associated with the proposed project would contribute to increased adverse impacts on soils, vegetation, wildlife, historic, and scenic resources within the project vicinity.

Table 5.10-2. CRITERIA AND ASSUMPTIONS USED TO CALCULATE VISITOR HOURS[a]

1. Construction-Worker Camp Alternative

Assumptions (1993 average):

- 448 workers and families in towns
- Average 300 workers in construction-worker camp
- In 1993, 748 total construction population (22 Wells, 139 Elko, 18 Jackpot, 269 Twin Falls). In 2000, construction-worker camp alternative average same as 1993, plus operation)
- Moor Summit (309 Elko, 63 Wells, 76 Wendover)
- Average of 50% of worker population in towns would recreate at any given time
- Average of 10% of construction-worker camp would recreate at any given time
- Average outdoor recreation season is May 15 - October 30 (24 weeks)
- Average recreationist may use 50% of recreation season or 12 weeks
- Three holidays occur during that period
- Average population would recreate 1 day during work week at any given time.
- Recreation visitor day is equal to an overall average of 8 hours.

Average annual visitor hours = (448 workers x 50% + 300 workers x 10%) x [(24 weeks x 2-day weekends x 50%) + 3 holidays + 1 day during work week] x 8-hour average/day = 56,896 annual visitor hours.

2. Construction - No Construction-Worker Camp

Assumptions:

- 1068 workers and families in towns. Proposed action (53 Wells, 331 Elko, 43 Jackpot, 641 Twin Falls). Moor Summit (737 Elko, 149 Wells, 182 Wendover).

Table 5.10-2. CRITERIA AND ASSUMPTIONS USED TO CALCULATE VISITOR HOURS[a] (concluded)

(1068 workers x 50%) x [(24 weeks x 2-day weekends x 50%) + 3 holidays + 1 day during work week x (8-hour average/day = 119,616 annual visitor hours.

3. Operation

Assumptions: (2000 average)

- 722 operation workers and families in town: Proposed action (217 Elko, 79 Wells, 43 Jackpot, 383 Twin Falls)
- 60% of operation population would recreate at any given time.

(722 workers x 60%) x [(24 weeks x 2-day weekends x 50%) + 3 holidays + 1 day during week] x (8-hour average/day) =

97,040 annual visitor hours (operation)

+56,896 annual visitor hours construction (w/construction-worker camp)

153,936 annual visitor hours/year 2000 average (with construction - worker camp)

216,656 annual visitor hours/year 2000 average (without construction-worker camp)

[a] Population figures were calculated using the methods and assumptions described in Appendix B.

5.10.1.3 Operation

Direct and indirect impacts would not change substantially from those described for the construction phase of the proposed action. The operation workforce, assuming 722 operation workers and families in 2000 (the peak workforce year) would create an estimated 97,040 annual visitor hours of increased recreational demand. Impacts would remain as identified in Table 5.10-1. The communities of Elko and Wells would receive a moderate recreational demand for additional open space and parkland if the existing ratio of population to open space and parkland is to be maintained. Elko would need an additional 5.7 acres of recreational open space and parkland. Wells would need 13.4 acres of recreational open space, Jackpot 6.4 acres, and Twin Falls 77 acres.

5.10.1.4 Combined Construction and Operation

Adverse recreational effects would not be significantly different with the combined activities of construction and operation for the proposed action over the construction or operation phases of the proposed action.

For the proposed action, with the combined construction and operation workforces, a total of 9.3 acres of park land and open space would be required by Elko. For Wells, a total of 17.0 acres of open space would be required. Jackpot and Twin Falls would require 9.1 acres and 111.0 acres, respectively. The proposed action would add 153,936 annual visitor hours per year. Similar recreation demand hours would be generated for each alternative.

Increased fishing and hunting pressure on game resources would be offset by the increased revenues available to the state through the sale of fishing and hunting licenses and equipment. The sale of state fishing and hunting licenses are matched by Federal money to provide funds for stocking and tagging fisheries programs, and big-game management programs. Other sources of funds include excise taxes on hunting and fishing goods such as rifles, and fishing and boating equipment. In general, the people who benefit from the use of fishing and hunting resources pay for the programs to maintain them (Weller 1989). The state and Federal funds from increased license and equipment sales is, therefore, expected to offset the increased use of these resources by project-related workers.

5.10.2 ALTERNATIVES

5.10.2.1 Alternative Access Roads

Moor Summit Road. With the proposed construction-worker camp, this alternative would create a greater demand for open space in the communities of Wells, Elko, and Wendover than the proposed action, and would reduce the impacts in Twin Falls and Jackpot. To maintain the present ratio of population to open space during the peak construction years would require an additional 10.6 acres in Wells, 8.1 acres in Elko, and 8.9 acres in Wendover. An additional 56,896 annual visitors hours would be generated by this alternative. During the peak operation year, the demand for open space in these communities would be 10.6 acres in Elko, 35.3 acres in

Wells, and 12.8 acres in Wendover. The impact of combined peak construction and operation workforce years would require 18.7 acres in Elko, 46.0 acres in Wells, and 21.6 acres in Wendover.

Brush Creek Road. This access alternative would have the same impacts as the proposed action.

5.10.2.2 Alternative Construction-Worker Accommodations
Not constructing the construction-worker camp at the plant site would require that workers reside in local communities, creating a greater demand for open space and parkland than the proposed action. With the access road constructed to Wilkins, the increased demand (during the peak construction year [1993]) for these resources is predicted at 90 acres for Wells, 8.7 acres for Elko, 6.4 acres for Jackpot, and 129 acres for Twin Falls. With the access road built to Moor Summit, the additional demand would be 103 acres for Wells, 19 acres for Elko, and 21 acres for Wendover.

At the peak construction-operation year (2000), increased demand for open space and parklands with no construction-worker camp is predicted at 14 acres for Elko, 22 acres for Wells, 13 acres for Jackpot, and 206 acres for Twin Falls with the proposed Wilkins access road. With the Moor Summit alternative, the demand would be 30 acres for Elko, 60 acres for Wells, and 34 acres for Wendover.

5.10.2.3 Land Acquisition Alternatives
Under the Rights-of-Way Grant alternative, no significant impacts to recreation resources would occur with the land acquisition alternatives. Under the Selling of Public Lands Alternative, hunting activity and sightseeing could be reduced or eliminated on the selected lands near the power plant due to private ownership.

5.10.3 MITIGATION

The following mitigation measures are recommended to reduce project-related impacts to recreational resources:

- Implement periodic environmental education/training for ORV use, firearms safety, hunting regulations, wilderness use ethics, and developed recreational site use and ethics.

- Provide additional acreages to surrounding communities (Wells, Elko, Jackpot, Twin Falls) for city parks and recreational facilities.

5.11 SOCIOECONOMICS

This section describes potential impacts to population; employment and income; housing; community services and facilities; public finance; and social conditions in the study area that would result from implementation of the proposed action or alternatives.

The land exchange component of the proposed action would have a limited effect on the socioeconomic issues itemized above. The consolidation of public lands would have a benefit to social conditions. The land exchange is not discussed further in this analysis.

The description of the potential consequences of the construction and operation components of the proposed action is combined because of the overlapping construction and operation schedules of the power plant. The analysis describes project impacts at three points: when the construction workforce would peak, when the total workforce (construction plus operation) would peak, and when the operation workforce would peak when all units are constructed. Alternatives analyzed here include "no construction-worker camp" and Moor Summit access (with and without a camp). The impacts associated with the Brush Creek alternative would be essentially the same as those with the proposed access route.

Threshold indicators are used in this analysis to identify potentially significant socioeconomic impacts. Adverse socioeconomic impacts are indicated if the capacity of existing and planned housing and community services and facilities is insufficient to meet the anticipated demand associated with projected project-related population increase. The issue of capacity is particularly critical in a rural area that is already experiencing increased demand on its services for reasons other than the proposed future project.

A detailed discussion of the methods and assumptions used to develop the population and employment projections is provided in Appendix B. A sensitivity analysis conducted on several of the assumptions is provided in Section 5.11.3.

5.11.1 PROPOSED ACTION

5.11.1.1 Employment and Income

The proposed project would result in an increase in the number of jobs in the area. These jobs would include direct employment in power plant construction and operation and indirect or support jobs. The size of the workforce would fluctuate with the planned construction schedule, which entails completion of a power plant unit every 2 years until all units are constructed (2008). The actual schedule for implementation would be in response to market demand. Following the planned schedule, the peak construction workforce would consist of a combination of some workers finishing one unit as others begin another unit. The construction workforce would peak during approximately 1 to 3 months during Summer 1993. The average workforce during that same year is expected to be approximately 500. The peak total workforce, consisting of approximately 800 construction workers and 300 operation workers, is anticipated to occur in the year 2000.

Upon completion of the first unit, operating workers would be needed. It is anticipated that 115 workers would be needed to operate the first unit and that approximately 140 workers would be required to operate each pair of units (see Appendix B for a more detailed discussion of workforce requirements). The operating workforce would steadily increase as units were completed, reaching a workforce of 564 upon completion of eight units (2008). In addition, some construction workers would be employed at the plant during 2008 and 2009. The workforce in 2010 would consist of only operation workers.

The indirect or support jobs associated with this project include the additional jobs that support the construction and operation of the power plant and the jobs that are generated to serve the needs of the inmigrating workers and their families. It is estimated that these support jobs could total as few as 120 or as many as 375 additional jobs during the peak construction period, and as few as 225 or as many as 420 additional jobs associated with the operation workforce at full buildout of the power plant. Additionally, it is anticipated that these support jobs would be filled by unemployed residents, dependents (spouses and high school-aged children) that accompany construction and operation workers, and other people that could inmigrate to fill the new positions. Elko County had 830 unemployed persons in 1987 and the City of Wells had approximately 50 people unemployed in 1988. In addition, these jobs could be filled by high school graduates from Wells that have previously left Wells to seek employment. The support jobs would primarily employ unskilled labor at low wages, and it is unlikely that many people would relocate to fill these jobs. Depending on the number of people that inmigrate for the support jobs, the populations in the local communities could increase slightly.

The average hourly wage for construction workers associated with the power plant is estimated to be $17.83 in wages or $32.11 in wages, subsistence, and fringes in 1988 dollars. The equivalent bare labor annual wage for construction workers would be $35,700, which is approximately double the average annual wage in Elko County ($17,441 in 1987) (NENDA and SPR 1989). Estimated annual payroll for the average workforce would be $17.8 million (in 1988 dollars). The total anticipated payroll (bare labor) associated with construction of the first power plant unit is over $48 million (in 1988 dollars). Using an income multiplier of 1.92 (meaning one dollar spent on wages induces an increase of $0.92 in other incomes)(California Department of Corrections 1988), the annual average payroll of $17.8 million would induce another $16.4 million in other incomes.

The higher wages would provide an economic boost to the local communities and would stimulate secondary employment or the creation of service jobs. If the workers spent an average of 37 percent of their annual gross pay in the local communities (US Department of Commerce [USDC] 1975), the amount of worker expenditures generated in the communities would be approximately $6.5 million annually. Sales tax associated with these expenditures would also be generated from the sale of taxable items. If it

is assumed that 35 percent of all expenditures are made on taxable goods (Bureau of Labor Statistics 1984), then approximately $2.3 million would be spent on taxable goods. Based on a sales tax rate of 6 percent, it is estimated that approximately $138,000 in sales tax revenues would be generated annually.

As new residents moved into the local communities, additional jobs would be created to meet their needs. The workers residing at the construction-worker camp, on the other hand, would buy limited personal items such as beverages and gasoline in the nearby towns of Wells and Jackpot after work and on weekends. It has been found that most workers who live in construction-worker camps have primary residences in cities such as Reno, Salt Lake City, Twin Falls, etc. These workers tend to commute home to their families on the weekends. However, a small number of construction-worker camp residents would utilize local services on the weekends. The construction-worker camp would generate support jobs for cooking and cleaning, and these workers could also reside at the work camp. The operation of the construction-worker camp itself would require goods and services, the majority of which would be purchased from the local communities.

5.11.1.2 Population

The population estimates presented in this section are based on population models described in Appendix B. These estimates are "best guesses" based on numerous assumptions and should not be used for planning purposes. It should be noted that future changes in local conditions, such as construction of new, reasonably priced housing in Wells or Jackpot, could result in attracting more workers to these communities than the models predict. A sensitivity analysis for the assumptions used in the models is provided in Section 5.11.3.

The inmigrating workers would cause a population increase in the local communities. Spouses and dependents would accompany workers, resulting in an additional population increase. Due to the restrictions of living in a construction-worker camp, children could not accompany workers to the construction-worker camp, and would likely remain at the workers' current residence. Use of the camp, containing 220 dormitory-style rooms and 300 recreational vehicle (RV) spaces, would meet the fluctuating housing needs of a construction workforce. The increase in population in the local communities throughout the construction phase is anticipated to remain somewhat constant. Workers who prefer to live in town or workers with families accompanying them would lodge in the local communities. As the total number of workers changed from below average to average to peak number of construction workers, the construction-worker camp could house the additional workers.

Table 5.11-1 presents the expected increase in population in Elko and Wells with the proposed action. The percentage of increase to projected population in Elko would range from 1 to 3 percent during the years analyzed, while in Wells it would range from 2 to 11 percent during the

Table 5.11-1. PROJECTED INCREASE IN POPULATION FOR ELKO AND WELLS FOR THE PROPOSED ACTION

	1988 Elko Population	Projected Elko Population	Project-Related Population Increase in Elko			1988 Wells Population	Projected Wells Population	Project-Related Population Increase in Wells		
			Number	% of 1988	% of Projected			Number	% of 1988	% of Projected
Peak Construction (Year 1993)	16,000	19,300	139	1	1	1400	1490	22	2	1
Peak Workforce (Year 2000)	16,000	25,000	356	2	1	1400	1630	101	7	6
Operation Workforce (Year 2010)	16,000	36,300	408	3	1	1400	1896	150	11	8

Note: Assumes peak workforce of 805. These estimates for communities would decrease slightly for an average workforce as workers on the waiting list for the construction-worker camp move into the camp.

same years. The City of Elko experienced an increase of 1300 residences (10 percent) between 1987 and 1988. An increase of the magnitude expected for the power plant would occur in the long term and is not anticipated to be a significant impact by local administrators (Boucher 1989; Lipparelli 1989). The increase in Wells is expected to occur primarily with the settling of the operation workforce in a community located closer to the plant site. The population increase of 6 percent by 2000 and the permanent increase in population of 8 percent over projected population in the City of Wells by 2010 would be significant.

5.11.1.3 Housing

The proposed action would result in the construction of 220 dormitory-style units and 300 RV spaces (each of which could house more than one person) at the project site. In addition, an estimated 205 workers would require housing in the local communities during the peak construction period. This number would decrease slightly during average construction periods. The projected distribution of workforce housing demand between Elko and Wells is presented in Table 5.11-2. At peak construction (1993), 62 housing units would be required in Elko and 10 would be required in Wells (Table 5.11-3). Demand for housing associated with the TSPP project would be a maximum of 3 percent of the current housing stock in Elko and a maximum of 11 percent of the existing housing stock in Wells over the life of the project. Elko would be able to accommodate the increased demand for project-related housing unless the mining activity continues to grow or additional housing is not built to accommodate normal growth. The power plant housing demand by 2010 in Elko would be approximately 15 percent of the 1000 new housing units constructed in 1988. Although these units would not remain empty until the operation workers arrived, it is a measure of the amount of construction that is currently occurring versus the project-related demand that would occur many years in the future. The demand for housing units in Wells could be significant for the peak construction workforce due to the small number of existing housing units, the lack of vacancies, and the demand for housing that will be associated with non-project-related growth.

5.11.1.4 Community Services

Schools. For the purpose of this analysis, it is assumed that a new classroom is required for every additional 25 students in Elko (Billings 1989). This guideline is consistent with the 1988-1989 school year average classroom size in Nevada, which is 25.7 (L. Smith 1989). For every 10 new classrooms, new common facilities would need to be built, including multi-purpose, art, and music rooms. In addition, library and kitchen facilities would need to be expanded. Personnel would need to be hired, including one teacher for every classroom, as well as guidance counseling, secretarial, and custodial staff. For additional students in Wells, it is assumed that a new classroom would be required for every additional 10 students because it would be more difficult for the small number of existing classrooms to absorb the new students (Billings 1989). Classroom requirements are overstated because high school-aged children accompanying construction and operation workers can be accommodated in the schools.

Table 5.11-2. PROJECTED HOUSING NEEDS IN ELKO AND WELLS FOR THE PROPOSED ACTION[a]

	Elko Current Housing Stock	Housing Needs Elko Number	Housing Needs Elko % of Current	Wells Current Housing Stock	Housing Needs Wells Number	Housing Needs Wells % of Current
Peak Construction (Year 1993)	5200	62	1	500	10	2
Peak Workforce (Year 2000)	5200	143	3	500	40	8
Operation Workforce (Year 2010)	5200	152	3	500	56	11

[a] Based on average construction workforce of 500 and peak construction workforce of 805.

Table 5.11-3. PROJECTED SERVICE DEMANDS ASSOCIATED WITH NON-PROJECT-RELATED AND PROJECT-RELATED GROWTH IN ELKO AND WELLS FOR THE PROPOSED ACTION

	Elko				Wells			
	Existing	1993	2000	2010	Existing	1993	2000	2010
Housing (units)	5200				500			
Demand of growth		1000	2700	6150		30	80	160
Project-related demand		62	143	152		10	40	56
School Enrollment (students)	4995				432			
Additional enrollment		956	2341	5278		26	67	133
Project-related enrollment		35	88	99		6	25	36
Demand for classrooms		38	93	212		3	7	14
Project-related classrooms		2	4	4		1	3	4
Law Enforcement (officers)	31				5			
Demand for officers		6	17	41		0	0	0
Project-related officers		0.3	0.7	0.8		0	0	0
Fire Protection (workers)	21				15			
Demand of growth		2.0	5.4	12.3		0.4	1.0	1.9
Project-related demand		0.1	0.3	0.3		0.1	0.5	0.7
Medical Care (doctors)	16[a]				1			
Demand of growth		3.3	9.0	20.3		0.1	0.2	0.5
Project-related demand		0.1	0.4	0.4		0.0	0.1	0.2

[a] The number of doctors in Elko County is not sufficient to accommodate existing demand. Elko County needs to hire nine doctors to be at a typical service ratio.

Under the proposed action, the number of school-aged children in Elko would increase by 35 during the peak of construction, by 88 in 2000, and then by 99 with the operation workforce (Table 5.11-3). Using the analysis criteria discussed previously, two classrooms would be required in Elko in 1993 as a result of the proposed action. The need would temporarily increase to four classrooms in 2000 and remain there for the operation workforce in 2010. These classrooms are in addition to the 93 classrooms in 2000 and 212 classrooms in 2010 needed to accommodate future non-project-related growth. The need for classrooms in Wells would be one classroom for six children during peak construction and three to four classrooms associated with the 25-36 children during peak workforce and the operational workforce, respectively. Common facilities could be required in Wells. The salaries for the additional teachers would be provided by the State Distributive School Fund, which is proportional to the number of students in a school district and would increase with the new students. Funding for the classrooms and facilities would be provided from property and sales tax revenues. There could be a lag between the generation of the tax revenues and the time that the new facilities would be required.

Law Enforcement. The demand for law enforcement in the local communities would increase as a result of the proposed project because of the increase in population. The applicant would employ security officers to patrol the power plant site.

The construction-worker camp would house a minimum of 520 workers at full occupancy. The population at the construction-worker camp would likely be higher than 520 because the RV spaces would allow a worker and a spouse, or a group of workers to occupy one RV space. Some of the residents of the construction-worker camp would visit the local communities during evenings and weekends, most likely Wells. Construction-worker camp operators have previously had a policy that if any worker residing in the construction-worker camp caused problems, the worker would be banned from the construction-worker camp. In addition, the security officers hired for the power plant would make periodic checks of the construction-worker campgrounds. In the past, these preventive measures have been sufficient to reduce law enforcement problems in the construction-worker camp to almost zero. For these reasons, this analysis assumes that law enforcement demand would be generated only by those workers who reside in the communities, since demand generated by the construction-worker camp is expected to be negligible.

The law enforcement needs associated with keeping coverage at a level of 2.0 officers for 1000 residents are presented in Table 5.11-3. The estimation of a fraction of an officer (e.g., 1.5) is meant to describe a situation of more law enforcement demand than one officer could handle but not enough demand to justify the employment of a second officer. Elko would likely accommodate additional project-related demand until approximately 2000, when one officer would be required. The annual cost to the City of Elko of one officer would be approximately $31,000 (Lipparelli

1989). The existing number of officers in Wells would allow sufficient coverage for existing population, the projected population growth, and the project-related growth. The City of Wells would not require additional law enforcement services.

Fire Protection. There would be an increase in demand for fire protection as a result of the construction and operation of the proposed power plant. Usual emergency assistance would be given by the Nevada Division of Forestry, the BLM, and the cities of Elko and Wells.

For this analysis, it is assumed that the increase in fire protection services is derived from the workers and families located in the local communities. Table 5.11-3 presents the number of firefighters needed to remain at a level of two firefighters for 1000 dwelling units. It is unlikely that the City of Elko would need to hire an additional firefighter due to project-related demand because of the existing high level of service and because of the slight incremental increase in projected demand for service. It is unlikely that the City of Wells would require additional volunteers for the project-related population for the same reasons.

Medical Care. The proposed project would result in increased demand for medical care for construction and operation workers and their families. Victims of accidents which occur on the project site would need transportation to the nearest hospital, which is Elko General Hospital, 90 miles distant. The applicant would have a vehicle outfitted as a medical transport vehicle and additional backup transportation to be used in case of an emergency. Employees sustaining non-life-threatening accidents would likely be driven by their employers to receive medical attention. An emergency medical crew would be formed on site, headed by the site safety officer and consisting of employees of the contractors and the owners. On-site facilities and services would include a first-aid room with a registered nurse or nurse practitioner available during working hours. In case of emergency at night, the members of the emergency medical team that resided at the construction-worker camp could be called. In addition to first aid provided on site, increased demand for care would be associated with construction and operation workers during nonwork hours, and their families at all times. Depending on the location of residence and the severity of the medical concern, people would be served by the 16 physicians at the Elko General Hospital or the one doctor at the Wells Medical Center.

The addition of project workers and their families to the City of Elko would exacerbate the difficulties associated with the current doctor shortage. The existing 16 physicians serve a county population of more than 26,000 residents. The resulting service ratio of 0.6 physicians for 1000 residents is below a typical ratio of 1.0 physicians for 1000 residents (Leistritz and Murdock 1981). Using the typical service ratio, Elko General Hospital needs to hire nine doctors and would need to hire one additional physician in order to serve the increased population associated with the proposed project. In addition, physicians will be needed to

accommodate non-project-related growth (Table 5.11-3). Elko County is currently experiencing difficulty attracting needed physicians and has formed a Physician Recruitment Committee.

Presently, one doctor serves the entire Wells population of 1400. With the addition of up to 150 operating workers and family members, the City of Wells would need to retain a physician's assistant or a nurse practitioner, according to the Wells physician. The existing medical building would need to be replaced (J. Smith 1989).

Water Supply. There would be an increased demand for water supply associated with the increase in population resulting from project construction and operation.

Under the proposed action, only the workers residing in the communities would increase demand for the local water systems. The residents in the construction-worker camp would be served by the groundwater being used for the power plant (discussion is provided in Section 5.5.1.2). The maximum annual increase in population in Elko would range from 1 to 3 percent over the course of the project. The water system would be adequate to serve the anticipated increase in population in Elko associated with the project, depending on the growth in population that occurs in Elko between 1989 and 1991. The city will need to accommodate water demand associated with non-project-related growth.

The population in the City of Wells would increase by 11 percent over current population during the operation phase. If the improvements that the City of Wells has planned do occur, and if the conservation measures do save a significant amount of water, the city could support this increased population. Otherwise, the city could not support the additional population without the planned improvements and conservation.

Sewer Supply. The wastewater associated with the construction-worker camp and power plant would be placed in one of the evaporation ponds associated with the power plant. There would be an increased demand for wastewater treatment associated with the construction and operation workforces and their families residing in the communities. Once planned sewer facility improvements occur, the City of Elko could serve the wastewater needs of non-project-related growth and the needs of the construction and operation workforces residing within the city. The City of Wells would not be able to accommodate the demand associated with the increased population with the system as it exists currently. The city anticipates that the installation of meters on the water system will decrease the water use and, consequently, the amount of wastewater treated daily. If the wastewater amount does not decrease, improvements to the Wells system would be required to accommodate the workers and their families.

Solid Waste Disposal. The proposed action includes a landfill to dispose of the waste from construction of the power plant (i.e., no human or hazardous waste would be disposed).

There would be demand for solid waste disposal associated with construction workers and operation workers and their families of approximately 4 pounds/person/day (C. Williams 1989). During the early construction phases, the City of Elko could accommodate the additional solid waste that would be generated by the workers, who choose not to reside in the construction-worker camp, in addition to that generated by non-project-related growth. Solid waste disposal for the City of Elko would only be possible for 3 to 5 years after construction began, after which a new landfill would need to be developed. A greater proportion of the solid waste associated with the construction workers would need to be disposed of in the Wells landfill because the solid waste generated at the construction-worker camp would be disposed by the City of Wells Sanitation Company. The City of Wells could only service the workers and their families if the proposed landfill site is approved by the BLM and developed.

Libraries. Use of the library services would increase with the construction and operation of the power plant because of the increase in population in the communities. This use is in addition to the additional use associated with non-project-related growth. The circulation of 160,000 volumes for the 26,790 county residents is approximately 6 volumes per person each year.

With the proposed action, residents of the construction-worker camp would probably not utilize the services provided by the library system. However, use would increase if the Elko County Library System decided to reroute the bookmobile to the project site to serve the construction-worker camp residents. WCC's socioeconomic survey conducted in association with construction of the Valmy power plant reported that the Humboldt County Bookmobile began its service to Valmy and Golconda during the peak construction period in response to the increase in the Valmy-area population. The bookmobile staff reported a large loss of books, which they attributed to the Valmy workers (WCC 1982b).

Increased usage of the library services would result from the increase in the population in the communities of Elko, Wells, Jackpot, and Twin Falls. Under the construction-worker camp alternative, population in the communities would increase by 1362 during the operation phase. This would result in an increased annual circulation of 8172, approximately half of which would be experienced in Twin Falls County. The increased annual circulation in Elko County would be a 3-percent increase over current circulation. In addition, the children that accompany the workers would utilize the children's programs that are provided by the Elko and Wells branch libraries.

5.11.1.5 Public Finance

The primary sources of revenue generated in the area would be the taxes associated with the construction and operation of the power plant and the increased number of high incomes in the area. The tax revenues are discussed below. Income impacts are discussed in Section 5.11.1.1.

Property Tax. This project is proposed by a private entity and does not cross the Elko County line. For that reason, it would not appear to be a centrally assessed property and would be valued and taxed within Elko County. However, preliminary discussions concerning the proposed project that have occurred at the State Legislature level appear to view the project as if it were one proposed by a public utility. The State Legislature has the power to decide whether a property should be centrally assessed and how the value should be distributed among the counties. TSGC does not currently and will not in the future own any transmission lines, so the line-mile distribution of value would be unlikely. However, value distribution has also occurred based on relative populations in all the counties. It cannot be assumed that the property would be valued and taxed by Elko County.

To estimate the amount of property tax that would be involved, the estimated capital investment for the first unit in 1994 is $453.4 million, including interest and escalation to 1994. This construction cost is reduced by the 1988-89 cost-to-value conversion factor for electric companies. This current conversion factor is 0.9223 and the resulting value is $418.2 million. The assessed value of the property is 35 percent of the value, or $146.3 million. The 1988-89 property tax rate in Elko County is $1.8535 per $100 of assessed value (Elko County Assessor's Office 1989). For the purpose of analysis, it is assumed that the tax rate would be approximately $2 per $100 of assessed value. The resulting property tax would be $2,900,000 for the first unit in its completion year (Table 5.11-4). Approximately 70 percent of the tax revenue would be dedicated to the school district, including $730,000 for capital projects. Property tax of a lesser amount would be levied during the construction years, depending on the construction cost that had been incurred at that point in time.

Elko County could receive less of a beneficial impact if the project is treated as a centrally assessed property. Elko County contains approximately 2.5 percent of the population in the State of Nevada. If the population distribution method were chosen, the tax revenues accrued by the county would be $72,500 instead of $2,900,000 for the first unit (Table 5.11-4).

Sales and Use Tax. Sales and use tax revenues would be generated during both the construction and operation phases. It is estimated that sales and use taxes associated with the materials used during the construction of the first power plant unit would be $8,747,600 (in 1988 dollars). Approximately $2.2 million of the sales tax revenues from the first unit would be designated for Elko County School District, $3.4 million would be designated to the county and its cities, and $85,000 would be distributed

Table 5.11-4. PROJECTED TAX REVENUES (1988 $) GENERATED FOR ELKO COUNTY (THOUSANDS OF DOLLARS)

	Taxed as Private Entity		Taxed as Centrally Assessed Property	
	First Unit (1994)	Four Units (2000)	First Unit (1994)	Four Units (2000)
Property Tax				
Elko County	870	3,480	22	88
School District	2,030	8,120	51	204
TOTAL to Elko County	2,900	11,600	73	292
Sales & Use Tax				
Elko County	3,500	14,000	3,500	14,000
School District	2,200	8,800	2,200	8,800
TOTAL to Elko County	5,700	22,800	5,700	22,800
Total Revenues				
Elko County	4,370	17,480	3,522	14,088
School District	4,230	16,920	2,251	9,004
TOTAL to Elko County	8,600	34,400	5,773	23,092
Project-Related Services Demand Requirements in year 2000				
Elko County				
Elko Police Officer		31		31
Possible new landfill		N/A		N/A
School District				
4 classrooms in Elko		1,800[a]		1,800[a]
3 classrooms in Wells				

[a] Source: Paul Billings, Elko County School District. Estimate for 500 children is $ 3 million. Estimated cost of $1.8 million is for an estimated 300 children.

N/A = Not Available

to Elko County from the state's share of $3 million, based on its population (2.5 percent of the state's population). The $3.4 million would be considered part of the "capped" revenues. The revenues would be allowed to increase by a state-designated percentage. If the supplementary sales tax revenue increased by this magnitude, the property tax rate in the county would decrease.

Sales tax revenues would also be generated as construction and operation workers spent their salaries. Sales taxes for major purchases would likely be divided between Elko County; Salt Lake City, Utah; and Twin Falls, Idaho (Section 2.2 of the Socioeconomics Technical Report).

Total Revenues Generated. The total revenues generated by the proposed project (in 1988 dollars) for Elko County would be $5.7 million in sales and use tax for every unit that was constructed and $2.9 million in property tax that would accrue annually for each unit constructed. By 2000, when most of the additional community services would be required, revenues that would be paid include a total of $22.8 million in sales and use tax for the four units constructed and $11.6 million annually in property tax for the four units (Table 5.11-4). If the proposed project were taxed as a centrally assessed property, the annual property tax revenues could decrease to approximately $290,000, including $87,000 not dedicated to the schools. The amount of tax revenues (property tax and supplemental state sales tax) would only be able to increase by a certain percentage. The minimum increase of 6 percent would result in an additional $230,000 in revenues, based on 1988 budgets for property and other taxes. This amount could increase more if the state allows a higher percentage of growth (allowed growth in 1988 was 16 percent [Salicchi 1988]).

The non-school-related annual revenues could be used to cover the salary of a police officer in Elko ($31,000). Therefore, the revenues generated by the project are sufficient to cover additional operating costs, even if the project is treated as a centrally assessed property. The $8.1 million annual property tax dedicated to the school and the $8.8 million from sales and use tax for four units could be used to build facilities for four classrooms in Elko and three classrooms in Wells by 2000. Approximately $3.4 million of the sales and use tax revenues would be directed to the county and its cities during the construction period of the first unit and could be used for construction of sewer improvements in Wells, and development of a new landfill in Elko County.

Approximately 75 percent of the construction cost of the first unit would be spent by the end of 1992. This would amount to $215,000 in property tax revenues and $6.5 million in sales tax revenues, including $1.65 million for Elko County School District. Approximately 95 percent of the construction cost of the first unit would be spent by the end of 1993. Approximately two classrooms would be needed in Elko and one classroom would be needed in Wells in 1993 to accommodate project-related growth.

5.11.1.6 Social Conditions

This analysis is based on population assumptions described in Appendix B. A sensitivity analysis for the assumptions is provided in Section 5.11.3.

City of Elko. No significant impacts to social organization or social well-being of Elko residents would likely occur. With the current mining-related population increase, the community is experiencing growth 15 times as great and ten times as fast as the maximum growth that would be associated with construction and operation phases of the proposed action (1 to 2 percent over 16 years). In addition, the TSPP-associated growth is much more predictable and, in the operation phase, more stable, than mining-related growth.

Elko city government and community leaders are pro-development. They express confidence that the leadership is competent and the existing organizational structure adequate to respond to the demands placed on the community by the current growth. Although existing facilities and services are strained by the current population increase, they perceive that response is underway. They feel that by the time that impacts of TSPP would begin to be felt, additional infrastructure, facilities, and diversified services will be in place. The future potential growth associated with TSPP is perceived as minor in comparison to the current boom. Thus, Elko city staff and community leaders consider that TSPP-associated impacts to the community resources and social well-being would be minor. This socioeconomic analysis supports Elko's perception that impacts on community resources would be insignificant.

Despite the optimism of Elko officials and community leaders, there remain some areas, such as recreation facilities, where present plans are not adequate to meet projected demand. The city may continue to be frustrated in its effort to build up medical personnel. Some of the planned growth in other areas may take longer than expected. Thus some short-term impact to citizens' access to resources is likely during construction phases of TSPP. Such deficiencies in services and facilities could affect some segments of the population, such as those on fixed incomes, more severely and over a longer time period than others. These segments, in particular, could feel their personal well-being diminished as a consequence of TSPP.

City of Wells. Impacts to Wells would be directly related to population increase, projected to be 2 percent within the first 2 years of construction, 7 percent by 2000, expanding to an increase of population by approximately 11 percent after final buildout when all units were operating. In the peak workforce years, Wells could experience significant short-term impacts on some community resources, with associated diminution of social well-being. There could be some long-term beneficial effects on social well-being.

Although city government and community leaders are pro-development, Wells has no prior experience with development on the scale that would be associated with TSPP. They have a greater opportunity with TSPP than Elko did with the mining boom to plan for a population increase and associated demands on community resources. They can use knowledge of Elko's experience in their planning efforts. However, they might not be able to avoid an after-the-fact response similar to Elko's because of legislative limitations on spending, and because of inability to attract private development in advance of actual population growth. Developers and entrepreneurs might wait to see if that analysis is correct before they invest in new housing construction or open retail outlets in Wells.

A housing shortage would have a negative impact on the personal well-being of some Wells residents if they choose to leave, or are forced out of, homes that could be lucratively rented or sold to incoming workers with higher salaries. Elderly people on fixed income are likely to be most affected by a housing shortage. City officials are aware of a concern about that issue from the elderly in Wells.

Wells' share of the construction jobs expected to be filled locally, plus the increasing number of support jobs that would be generated and filled locally as the city population grows during the years through full buildout would result in a net increase in employment. This would benefit both personal and social well-being in Wells.

One of the long-term benefits that Wells community leaders anticipate from population growth is increased diversity of shopping opportunities in the city. In the short-term, they could suffer a negative impact on personal well-being if prices rose and supplies became scarcer until business people responded to increased demand. Even the maximum projected population increase would be unlikely to induce the entrance of chain stores, and thus TSPP cannot be expected to alter shopping patterns significantly.

Wells community leaders expect that they could see an increase in crime and experience a diminished sense of security as a consequence of population increase. However, they feel that the construction-worker camp would reduce this potential effect, which is associated in their minds more with single construction workers than with families of construction and operation workers who might move into town. They acknowledge that police coverage in town is more than adequate to handle a substantial population increase.

Based on Elko's experience with the mining boom, it is anticipated that social organization in Wells would not change drastically as a result of TSPP-induced growth. Governmental structures of the two cities are similar, and Elko's has not changed in response to the boom. Wells' "doers" have demonstrated that they can work together despite disagreements and through changing administrations because they share the goal of economic development for the city.

It appears that tax revenues would be ample to fund the significant expansions of school facilities and minor expansions in police and fire-fighting capabilities that would be required. While the already limited medical facilities would be further stressed, this would be unlikely to change existing behaviors of residents, who already travel for specialty services.

The small-town, rural qualities of life that are valued in Wells could be changed some by an overall 11-percent increase in population, but such a change would not be significant, to judge by Elko. Community leaders of that city, now approximately 10 times as large as Wells, boast of the same desirable qualities of small-town life in their city as Wells community leaders do. And this is after a population increase in Elko much greater in speed and magnitude than that expected in Wells from TSPP.

5.11.1.7 Other Potentially Affected Communities

Twin Falls, Idaho. Twin Falls would be affected by the proposed action. Table 5.11-5 presents the number of workers, the number of school-aged children, and the total population increase anticipated in Twin Falls from the proposed action. Project-related population in Twin Falls would not result in more than a 2-percent increase in total population during any of the analysis years.

This new population represents 120 new households in 1993 and 279 new households in 2000 in Twin Falls. Households include single-person households and families. Single persons might consider motel accommodation and sharing of housing. Therefore, the housing stock required would not necessarily equal the total number of households stated above. The rental housing market in Twin Falls is expected to improve after 1990 with the commencement of construction on two subdivisions. Further construction is anticipated in the 1990s. The influx of new population in 1993 is not likely to strain the housing market, although the 279 households anticipated to move to Twin Falls by 2000 may encounter a housing shortage, if additional housing in six other subdivisions is not developed.

The proposed action would increase the school enrollment by almost 1 percent in 1993 and 2 percent in 2000. The schools are currently near capacity, and in the absence of any expansion of classroom space and personnel, the influx of project-related school children could strain the school system in Twin Falls.

Other community services are not expected to receive significant impacts from the proposed action. The service ratio for law enforcement would change from 1.65 to 1.64 in 1993 and from 1.55 to 1.52 in 2000, with the influx of new population relating to the proposed action. Similar minor impacts are anticipated on fire protection services and medical care. The utility services are presently under no constraints. Water supply is plentiful.

Table 5.11-5. PROJECTED INCREASE IN POPULATION IN TWIN FALLS AND JACKPOT FOR THE PROPOSED ACTION[a]

	Twin Falls			Jackpot		
	1993	2000	2010	1993	2000	2010
Number of Workers	120	279	269	8	26	30
Number of School-Aged Children	68	160	175	4	14	20
Total Population Increase	269	652	722	18	61	82
Total Projected Population of City (without proposed action)	29,331	31,546	34,710	2164	3246	5981
Project-Related Population as Percent of Total Projected Population	<1	2	2	<1	2	1

[a] Range is for average construction workforce of 500 and peak construction workforce of 800.

The one aspect of public finance that would receive impacts from the proposed action and alternatives would be an increase in retail sales and spending in the economy of Twin Falls. The new population would spend locally on housing, consumer goods, and transportation. This would generate sales tax revenues, part of which would be cycled through into the city's economy. Some indirect jobs would be created due to the influx of new population.

To summarize, while the influx of new population due to the proposed action is very small considering the large size of the City of Twin Falls, the present constraints on housing and school capacities could pose some problems in 2000, if housing stock and school capacities are not increased. Other community services are not expected to be affected by this relatively small influx because the city is not currently under constraints.

<u>Jackpot, Nevada</u>. Jackpot, like Twin Falls, is expected to receive impacts from the proposed action. Table 5.11-5 presents the anticipated influx of population into Jackpot resulting from the proposed action and the no construction-worker camp alternative. Project-related new population in Jackpot would not result in more than a 2-percent increase in the community population during any of the years analyzed.

This new population represents eight new households in 1993 to 30 new households in 2010 in Jackpot. As these households include single-worker households who could opt for motel accommodation and sharing, the total number of housing units required would not necessarily equal the total number of households. Low availability of rental housing could prove a constraint, although motel room availability is satisfactory.

A portion of the new population would be school-aged children. It is estimated that 4 to 20 school children would be added to the local school from 1993 to 2010 through the influx of population associated with the proposed action. Presently, there is excess capacity in the school at Jackpot. However, if the enrollment continues to grow at last year's rate, this capacity would be filled by 1995. In 1993, there would be room for the project-related school children. However, by 2000, if more facilities and staff are not added, the school would be required to work over capacity with or without the proposed action.

Impacts on other community services are not expected to be large. The service ratio for law enforcement would be 1.85 in 1993 without the proposed action and at 1.83 with the proposed action, if no additional officers are added before 1993. The ratio in 2000 would be 1.23 without the proposed action and 1.21 with the proposed action. Since the population increase in Jackpot associated with the proposed action would be small, most community services would not be affected significantly. However, coupled with the non-project-related population growth (Table 5.11-5), the increase could put strain on wastewater disposal and water supply systems.

Fiscal impacts on the local economy are not expected to be large. Except for spending on housing and some food in Jackpot, workers and their dependents would need to go to Twin Falls for most other requirements, as Jackpot does not offer many shopping opportunities.

Wendover/West Wendover, Utah, and Nevada. Wendover would not be affected under the proposed action.

5.11.2 ALTERNATIVES

5.11.2.1 No Construction-Worker Camp Alternative

Employment/Income. Under the no construction-worker camp alternative, a similar number of service jobs to the number of jobs under the proposed action would be associated with the construction and operation of the power plant, and with support of the inmigrating workers. These jobs would be located in the local communities.

Population. In the no construction-worker camp alternative, the population increases in the communities would be larger and of a greater range than under the proposed action. The range of population increases presented in Table 5.11-6 is for an average construction workforce of 500 and a peak construction workforce of 805. In years other than the peak year, the average workforce would be less than 500. The percentage of population increase in Elko in 1993 is expected to be 2 percent of the current population, with a 3 percent increase during the peak months. Response to the population increase in Elko could be easier due to the size of the city; however, Elko's ability to supply the needs of the increased population would be dependent upon the level of gold mining activity at the time of peak workforce demand. It is planned that mill construction by both Newmont and Barrick gold companies will be completed by 1991 (the first year of power plant construction), reducing the number of construction jobs in the area. However, new mining construction could begin, resulting in an increasing population associated with the mines, or gold prices could fall resulting in decreased gold production and therefore a decrease in jobs and population in the communities. Due to the extremely uncertain future in Elko, the significance of a 3-percent increase is unclear.

A 4 to 6 percent population increase in the City of Wells over current population could be significant because of the need for increased services, due to the cyclical nature of the increase. Although the percentage of the population increase near the end of the proposed project would be larger, the fact that the workforce would be stable, and that there would be a long planning time for the community, combine to make the impact less significant in terms of provision of services.

Housing. Under the no construction-worker camp alternative, all construction workers and their families would require housing in the local communities, creating a much larger demand for housing during the

Table 5.11-6. PROJECTED INCREASE IN POPULATION[a] IN ELKO AND WELLS FOR THE NO CONSTRUCTION-WORKER CAMP ALTERNATIVE

	1988 Elko Population	Projected Elko Population	Project-Related Population Increase in Elko			1988 Wells Population	Projected Wells Population	Project-Related Population Increase in Wells		
			Number	% of 1988	% of Projected			Number	% of 1988	% of Projected
Peak Construction (Year 1993)	16,000	19,300	331-532	2-3	2-3	1400	1490	53-86	4-6	4-6
Peak Workforce (Year 2000)	16,000	25,000	548-749	3-5	2-3	1400	1630	132-165	9-12	8-10
Operation Workforce (Year 2010)	16,000	36,300	408	3	1	1400	1860	150	11	8

[a] Range of increase is from average construction workforce of 500 to peak construction workforce of 805.

construction phase than under the proposed action. It is estimated that approximately 140 housing units would be required in Elko and approximately 23 units in Wells for the average workforce in 1993 (Tables 5.11-7 and 5.11-8). With the peak workforce during that year, a total of 223 workers in Elko and 36 workers in Wells would require housing. Due to the short duration of the peak during the summer months, it is likely that housing needs would be met in a variety of ways such as doubling or tripling up in available housing units. It is unlikely that the community would respond with new housing construction to meet the peak demand for housing. These units required for the increased population represent a significant increase in housing demand in these communities, although it would be for a relatively short time. In addition, many more housing units would be required for the construction workforce than would eventually be required for the operation workers. In Elko, this would amount to an excess of approximately 70 housing units if housing were constructed for the average total workforce. Resources and funds could have been used unnecessarily if other growth could not subsequently fill the vacant units.

Community Services.

Schools. The number of school-aged children in the school district would increase substantially if a construction-worker camp were not provided. This is because many of the workers who choose to live temporarily in a construction-worker camp leave their families in cities such as Reno, Twin Falls, Salt Lake City, etc. This means that their children continue to attend schools in those cities. The workers then commute home every weekend to be with their families. When an inexpensive construction-worker camp is not available, workers are more likely to choose to relocate their families to the vicinity of the job site, resulting in a greater impact on local schools.

Under the no construction-worker camp alternative, the increase in school-aged children in Elko would range between 61 to 113 children during the peak construction years (Table 5.11-8). The low end of the range is associated with the average workforce. Because the peak workforce occurs during the summer months, the school-aged children associated with the peak would not likely require space in classrooms. The number of new children in the communities would drop during other, nonpeak construction years. The number of classrooms needed in Elko would be three throughout the peak construction year. Five classrooms would be needed during the peak total workforce. It is likely that the Elko County School District would provide relocatable trailers to accommodate the temporary peak demand. A trailer could be removed when the needed number of classrooms would drop from five to four during the operation phase (Table 5.11-8).

The City of Wells would see similar increases, with one classroom needed in the peak construction period, three needed for students associated with the peak workforce, and four during the operation of the power plant. Additional common facilities would be also required. Due to the transient nature of the construction workforce and the associated unpredictable demand for classrooms, relocatable trailers would probably be

Table 5.11-7. PROJECTED HOUSING NEEDS IN ELKO AND WELLS FOR THE NO CONSTRUCTION-WORKER CAMP ALTERNATIVE[a]

	Elko Current Housing Stock	Housing Needs Elko Number	Housing Needs Elko % of Current	Wells Current Housing Stock	Housing Needs Wells Number	Housing Needs Wells % of Current
Peak Construction (Year 1993)	5200	140-223	3-4	500	23-36	5-7
Peak Workforce (Year 2000)	5200	221-304	4-6	500	53-66	11-13
Operation Workforce (Year 2010)	5200	152	3	500	56	11

[a] Range is for average construction workforce of 500 and peak construction workforce of 805.

Table 5.11-8. PROJECTED SERVICE DEMANDS ASSOCIATED WITH NON-PROJECT-RELATED AND PROJECT-RELATED GROWTH IN ELKO AND WELLS FOR THE NO CONSTRUCTION-WORKER CAMP ALTERNATIVE

	Elko				Wells			
	Existing	1993	2000	2010	Existing	1993	2000	2010
Housing (units)	5200				500			
Demand of growth		1000	2700	6150		30	80	160
Project-related demand (average workforce)		140	221	152		23	53	56
School Enrollment (students)	4995				432			
Additional enrollment		956	2341	5278		26	67	133
Project-related enrollment (avg)		61	113	99		10	29	36
Demand for classrooms		38	93	212		3	7	14
Project-related classrooms (avg)		3	5	4		1	3	4
Law Enforcement (officers)	31				5			
Demand for officers		6	17	41		0	0	0
Project-related officers		0.7	1.1	0.8		0	0	0
Fire Protection (workers)	21				15			
Demand of growth		2.0	5.4	12.3		0.4	1.0	1.9
Project-related demand		0.3	0.4	0.3		0.3	0.6	0.6
Medical Care (doctors)	16[a]				1			
Demand of growth		3.3	9	20.3		0.1	0.2	0.5
Project-related demand		0.3	0.5	0.4		0.0	0.1	0.2

[a] The number of doctors in Elko County is not sufficient to accommodate existing demand. Elko County needs to hire nine doctors to be at a typical service ratio.

the method utilized by the school district to meet the construction phase demand.

Law Enforcement. Under the no construction-worker camp alternative, all workers would reside in the local communities. The number of construction workers living in the communities would vary widely throughout the project life. It is assumed here that law enforcement officers would be hired based on the average annual workforce. It is unlikely that the hiring would respond to a peak, unless the communities noticed a drop in the level-of-service. The number of officers required to keep a standard level-of-service are presented in Table 5.11-8. Elko would likely require one officer in 2000. The City of Wells would not be likely to hire another police officer to accommodate the additional demand, due to the existing high service ratio.

Fire Protection. Under this alternative, all workers would reside in the local communities. The fire departments would likely add firefighters in response to the demand associated with an average workforce. Using the service ratios described above, the additional demands are presented in Table 5.11-8. It is unlikely that the City of Elko would need to hire an additional firefighter because of the existing high level of service and because of the slight incremental increase in projected demand for service. It is unlikely that the City of Wells would require additional volunteers for the same reasons.

Medical Care. Under the no construction-worker camp alternative, all workers would reside in the communities. This would provide the workers with better access to medical care than if they resided at the project site. Applying the standard service ratio to the average population increase associated with the project, approximately the same number of additional doctors would be required as under the proposed action (Table 5.11-8).

Water Supply. The water demand associated with this alternative would be higher than under the proposed action because of the higher number of local residents. The population increase in Elko would range from 2 to 5 percent, which could be served by the existing system. The population increase in the City of Wells would be larger during the construction period than with the proposed action, but would still reach a peak increase of 11 percent over current population during the operation phase. Thus, impacts on the City of Wells under this alternative would be similar to those identified for the proposed action.

Sewer Supply. The demand for sewer service associated with this alternative would be higher than that under the proposed action. However, the conclusions would be the same under each alternative. The City of Elko would be able to serve the workers and non-project-related growth once the planned facility improvements are completed. The City of Wells would require improvements to the sewer system to accommodate the growth if wastewater generated by city residents does not decrease.

Solid Waste Disposal. The demand for solid waste disposal under this alternative would be larger than under the proposed action because of the increased number of dependents who would accompany workers with the no construction-worker camp alternative. However, the City of Wells would have less solid waste to handle during the construction phase than it would under the proposed action. The conclusions would be the same as for the proposed action. The City of Elko could meet the increased demand during the early construction phase. The City of Wells would need to have additional landfill capacity approved and developed before it could accommodate the increased demand.

Libraries. Under the no construction-worker camp alternative, impacts similar to those of the proposed action would occur. The impacts would be greater during the construction phase as a result of the increased population and number of children. The population could increase to an average of about 700 in Elko County, for an increase in circulation by 4200 volumes. At the same time, the number of school-aged children would increase by 100 over the number associated with the proposed action, resulting in an even higher demand for children's programs at local libraries.

Public Finance. The need for additional community services to be supplied would be greater then those needed with the proposed action. They include another classroom in Elko by 1993, one classroom in Elko by 2000, and an additional police officer in Elko in 2000. Tax revenues generated by construction of the proposed power plant would be identical to those generated under the proposed action.

Social Conditions.

City of Elko. No long-term significant impacts to social organization or social well-being of Elko residents would likely occur, because the long-term population increase associated with this alternative is identical to that associated with the proposed action. During the period when a peak workforce would be present, Elko could suffer the same stresses on social well-being that have characterized the years of the mining boom, primarily associated with a housing shortage and corresponding inadequacies in public facilities. A major difference would be the scale of the disproportion between supply and demand, because the response to the mining boom will have increased Elko's infrastructure significantly by the time the TSPP peak workforce would be in place. Thus the shortages all around would be less severe. Elko would be able to draw upon its experience with the mining boom to consider costs and benefits inherent in responding to the short-term needs for housing and associated services during peak workforce years at TSPP.

City of Wells. Long-term impacts to Wells would be the same as those identified for the proposed action, including some long-term beneficial effects on social well-being, and no major impacts to social organization. In addition, there would be impacts related to a population increase

of 4 to 6 percent during the initial peak construction years, and an increase of 9 to 12 percent during the peak workforce years. During both of these periods, Wells could experience significant short-term impacts on some community resources, with associated diminution of social well-being.

Housing demands in the initial peak construction years and in peak workforce years could not be met with existing housing in Wells. As discussed for the proposed action, if Wells is not limited by water supply and sewage treatment capability, there would be no institutional constraints to housing starts. However, Wells could be unable to attract development in advance of actual population growth, even though the projected growth for this alternative should make the city more attractive to developers. Consequences of a housing shortage, if it occurs, would be the same as those indicated under the proposed action.

A greater negative impact on personal well-being could result from this alternative because Wells residents feel that the presence of single construction workers in the community would lead to greater incidence of crime and a lesser sense of security in their homes than would be the case if such workers resided at the plant site. This effect would be limited to the constructed phase of the project.

As with the proposed action, it appears that tax revenues would be ample to fund the even greater expansions of school facilities that would be necessitated by this alternative, and the still minor expansions in police and firefighting capabilities that would be required. Strains on community facilities would be felt earlier under this alternative, but the long-term effects would not differ.

Other Potentially Affected Communities. The effects to Twin Falls and Jackpot under the no construction-worker camp alternative would be of a greater magnitude than under the proposed action. Table 5.11-9 presents the anticipated increase in population and school-aged children. The population increase ranges from 2 to 4.5 percent in Twin Falls during the years analyzed and from 1 to 3 percent in Jackpot during the same time period.

Conclusions regarding availability of services would be the same as those for the proposed action (Section 5.11.1.7).

Wendover would not be affected under this alternative.

5.11.2.2 Moor Summit, Construction-Worker Camp Alternative

Employment/Income. With the Moor Summit access road, identical direct and indirect jobs would occur to those generated with the proposed action. However, the distribution of the 120 to 420 indirect jobs would be in Elko, Wells, and Wendover to support the new construction and operation workers that would reside in those communities. Some income from the direct and direct jobs would be cycled through these communities, while major purchases would likely still be primarily from Elko, Twin Falls, and Salt Lake City.

Table 5.11-9. PROJECTED INCREASE IN POPULATION IN TWIN FALLS AND JACKPOT FOR THE NO CONSTRUCTION WORKER-CAMP ALTERNATIVE[a]

	Twin Falls			Jackpot		
	1993	2000	2010	1993	2000	2010
Number of Workers	270-432	429-591	269	18-29	36-47	30
Number of School-Aged Children	117-188	209-280	175	8-13	19-24	20
Total Population Increase	641-1030	1024-1413	722	43-68	86-111	82
Total Projected Population of City (without proposed action)	29,331	31,456	34,710	2164	3246	5981
Project-Related Population as Percent of Total Projected Population	2-3.5	3-4.5	2	2-3	3	1

[a] Range is for average construction workforce of 500 and peak construction workforce of 800.

<u>Population</u>. The anticipated population increases in Elko and Wells with this alternative are greater than with the proposed action (Table 5.11-10). Population increases range from 2 to 5 percent of current population in Elko and 5 to 28 percent of current population in Wells. The increase of 21 percent of projected Wells population at full buildout would be significant.

<u>Housing</u>. Anticipated housing needs associated with this alternative of the proposed project are presented in Tables 5.11-11 and 5.11-12. The number of houses required in Elko and Wells would be greater with the Moor Summit Alternative. Housing needs range from 138 housing units for peak construction workforce to 289 housing units for peak total workforce in Elko. The need for housing units in Wells would gradually grow to 147 units for the operation workforce.

<u>Schools</u>. Under this alternative, more school-aged children would reside in Elko and Wells (Table 5.11-12). The number of classrooms required associated with project-related growth would increase from three to eight. Classrooms required in Wells would be two for peak construction to 10 for operation workforce. Common facilities would be required at that time.

<u>Law Enforcement</u>. The Moor Summit alternative would result in increased need for police officers in Elko and Wells because of the increased number of construction and operation workers and their families residing in these communities (Table 5.11-12). The number of officers required in Elko associated with the project would be 0.6 in 1993, 1.4 in 2000, and 1.5 in 2010. This is in addition to the estimated 6, 17, and 41 officers required during those same periods for non-project-related growth. The City of Wells would not be likely to hire another officer to accommodate the additional demand because of the existing high level-of-service.

<u>Fire Protection</u>. This alternative would result in higher fire protection demand than under the proposed action (Table 5.11-12). However, Elko would require less than one firefighter throughout the life of the project to maintain a typical level-of-service for project-related inmigration. The City of Wells could need to recruit one or two volunteers to serve the operation workforce.

<u>Medical Care</u>. This alternative would result in a higher demand for medical care (Table 5.11-12), but would have a similar impact as the proposed action.

<u>Water Supply</u>. This alternative would result in a population increase of 2 to 5 percent in Elko and 5 to 28 percent in Wells over current population. Impacts to the water system would be similar to the impacts under the proposed action.

Table 5.11-10. PROJECTED INCREASE IN POPULATION IN ELKO AND WELLS FOR THE MOOR SUMMIT, CONSTRUCTION-WORKER CAMP ALTERNATIVE

	1988 Elko Population	Projected Elko Population	Project-related Population Increase in Elko			1988 Wells Population	Projected Wells Population	Project-related Population Increase in Wells		
			Number	% of 1988	% of Projected			Number	% of 1988	% of Projected
Peak Construction (Year 1993)	16,000	19,300	309	2	2	1400	1490	63	5	4
Peak Workforce (Year 2000)	16,000	25,000	713	4	3	1400	1630	272	19	17
Operation Workforce (Year 2010)	16,000	36,300	763	5	2	1400	1860	395	28	21

Note: Assumes peak workforce of 805. These estimates for communities would decrease slightly for an average workforce as workers on the waiting list for the construction-worker camp move into the camp.

Table 5.11-11. PROJECTED HOUSING NEEDS IN ELKO AND WELLS FOR THE MOOR SUMMIT, CONSTRUCTION-WORKER CAMP ALTERNATIVE[a]

	Elko Current Housing Stock	Housing Needs Elko Number	Housing Needs Elko % of Current	Wells Current Housing Stock	Housing Needs Wells Number	Housing Needs Wells % of Current
Peak Construction (Year 1993)	5200	138	3	500	28	6
Peak Workforce (Year 2000)	5200	289	3	500	106	21
Operation Workforce (Year 2010)	5200	284	3	500	147	29

[a] Range is for average construction workforce of 500 and peak construction workforce of 805.

Table 5.11-12. PROJECTED SERVICE DEMANDS ASSOCIATED WITH NON-PROJECT-RELATED AND PROJECT-RELATED GROWTH IN ELKO AND WELLS FOR THE MOOR SUMMIT, CONSTRUCTION-WORKER CAMP ALTERNATIVE

	Elko				Wells			
	Existing	1993	2000	2010	Existing	1993	2000	2010
Housing (units)	5200				500			
Demand of growth		1000	2700	6150		30	80	160
Project-related demand		138	289	284		28	106	147
School Enrollment (students)	4995				432			
Additional enrollment		956	2341	5278		26	67	133
Project-related enrollment		78	175	185		16	66	96
Demand for classrooms		38	93	212		3	7	14
Project-related classrooms		3	7	8		2	7	10
Law Enforcement (officers)	31				5			
Demand of growth		6	17	41		0	0	0
Project-related officers		0.6	1.4	1.5		0	0	0
Fire Protection (workers)	20				15			
Demand of growth		2.0	5.4	12.3		0.4	1.0	1.9
Project-related demand		0.3	0.6	0.6		0.3	1.3	1.8
Medical Care (doctors)	16[a]				1			
Demand of growth		3.3	9.0	20.3		0.1	0.2	0.5
Project-related demand		0.1	0.4	0.4		0.0	0.3	0.4

[a] The number of doctors in Elko County is not sufficient to accommodate existing demand. Elko County needs to hire nine doctors to be at a typical service ratio.

Sewer Supply. This alternative would result in higher sewer demand in Elko and Wells than under the proposed action. However, the conclusions concerning impacts would be the same as for the proposed action.

Solid Waste Disposal. This alternative would result in higher demand for solid waste disposal in Elko and Wells than under the proposed action. However, the conclusions regarding impacts associated with project-related growth are the same as with the proposed action.

Libraries. The library usage under this alternative would be similar to that under the proposed action except that the West Wendover branch would also be utilized. The Elko County Library System would have more use because all workers would live in the county.

Public Finance. The need for additional community services under this alternative to be supplied that would be greater than those needed with the proposed action. They include one classroom in Elko and one classroom in Wells by 1993, three classrooms in Elko and four classrooms in Wells by 2000, four classrooms in Elko and six classrooms in Wells by 2010, and a police officer in Elko by 2000. Tax revenues generated by construction of the proposed power plant would be identical to those generated under the proposed action.

Social Conditions

City of Elko. This alternative would result in a greater population increase in the community of Elko than with the proposed action. The population increase associated with operation workers at full buildout would be 5 percent of current population and 2 percent of projected population in 2010. Impacts to community structure and social well-being would be similar to those of the proposed action.

City of Wells. This alternative would result in a larger population increase, particularly with permanent, operation workforce, than with the proposed action. The City of Wells population would increase by 28 percent of current population and 21 percent over projected population in 2010. This would intensify social effects described for the proposed action. However, the City of Wells civic leaders have expressed a preference for the Moor Summit access road alternative because they believe that this access road would result in greater economic benefit to their community.

Other Potentially Affected Communities. The communities of West Wendover and Wendover would receive impacts from the construction and operation of the proposed power plant under this alternative. Twin Falls and Jackpot would not be affected. Table 5.11-13 presents the number of workers that would reside in Wendover, the total population increase that would result due to the proposed power plant, and the number of school-aged children that would be added to Wendover communities as a part of this population influx. Approximately 14 percent of the construction workforce and 17 percent of the operations workforce would settle in the communities of Wendover. These people would increase population by 2 to 4 percent of the projected total populations in the two communities.

Table 5.11-13. PROJECTED INCREASE IN POPULATION IN WENDOVER FOR THE MOOR SUMMIT, CONSTRUCTION-WORKER CAMP[a]

Year	1993	2000	2010
Number of Workers	34	79	76
Number of School-Aged Children	19	46	49
Total Population Increase	76	185	204
Projected Population of Communities Without Project	4363	5132	5791
Project-Related Population as Percent of Total Population	<2	3.5	3

[a] Range is for average construction workforce of 500 and peak construction workforce of 800.

This new population represents 34 new households in 1993 to 79 new households in 2000. As these new households include single-worker households who could opt for motel accommodation and sharing, the total number of housing units required would not necessarily equal the number of households stated above. If new housing is not added before 1993 and the population continues to grow at the present rate, the apartments presently available would prove insufficient for the non-project-related population increase by 1993. However, if the population growth rate were to decline between 1989 and 1993, rental housing would be available for the project-related population. Motel room availability appears satisfactory except for holidays and special event periods.

The schools in the two communities are currently at capacity. Between 1993 and 2000, 19 to 46 school-aged children would be added to the local schools due to the proposed power plant. In view of the level of utilization of school capacities currently, if more facilities and staff are not added by 1993, the local schools would be operating over their capacities.

Impacts to other community services would be relatively smaller. The service ratio for law enforcement would be 2.13 in 1993 and 1.8 in 2000 without the project-related population, and 2.10 and 1.7 in the same years with the project-related population, if more officers are not added. In view of the reported water supply problems currently being faced, water supply is an aspect that might receive impacts from the project-related population.

The local economy would benefit from the spending on housing, food and transportation by the project-related population, although part of the income could be spent in Salt Lake City and Elko.

5.11.2.3 Moor Summit, No Construction-Worker Camp Alternative

Employment/Income. Under this alternative, effects would be similar to those under the proposed access, no construction-worker camp alternative with the 120 to 420 indirect jobs located in Elko, Wells, and Wendover. Some income from the direct and indirect jobs would be cycled through these communities, while major purchases would likely still be from Elko, Twin Falls, and Salt Lake City.

Population. The largest potential population increases in Elko and Wells are associated with this alternative (Table 5.11-14). The increase associated with peak total workforce in Elko would be 7 to 10 percent. Due to the uncertain future in Elko, the significance of this increase is unclear. However, a potential significant impact to the City of Elko could occur because of the anticipated project-related increase of 1142 to 1589 in 2000, which is then expected to decrease to 763 in 2010. The reduction of the workforce after the turn of the century could leave Elko with underutilized infrastructure.

Table 5.11-14. PROJECTED INCREASE IN POPULATION[a] IN ELKO AND WELLS FOR THE MOOR SUMMIT, NO CONSTRUCTION-WORKER CAMP ALTERNATIVE

	1988 Elko Population	Projected Elko Population	Project-related Population Increase in Elko			1988 Wells Population	Projected Wells Population	Project-related Population Increase in Wells		
			Number	% of 1988	% of Projected			Number	% of 1988	% of Projected
Peak Construction (Year 1993)	16,000	19,300	737-1184	5-7	4-6	1400	1490	149-240	11-17	10-16
Peak Workforce (Year 2000)	16,000	25,000	1142-1589	7-10	5-6	1400	1630	358-449	26-32	22-28
Operation Workforce (Year 2010)	16,000	36,300	763	5	2	1400	1860	395	28	21

[a] Range of increase is from average construction workforce of 500 to peak construction workforce of 805.

Impacts to the City of Wells would be caused by the influx of construction workers in the first few years of the project and the difficulty associated with planning for a temporary, cyclical construction workforce. A 26 to 32 percent population increase over current population in 2000 would be significant because of the need for increased services, especially due to the cyclical nature of the increase.

Housing. This alternative would result in significant housing needs in both Elko and Wells (Tables 5.11-15 and 5.11-16). Elko's highest demand would be associated with the peak total workforce in 2000. This demand would fall by almost 200 units for the operation workforce which could be an impact if funds have been used unnecessarily. The City of Wells would experience substantial cyclical demand for housing units in the early years of the project.

Schools. Need for classrooms to support project-related school-aged children would be greatest under this alternative (Tables 5.11-16). Demand for classrooms in Elko would be six for peak construction workers, and would increase to 10 for peak total workforce. Common facilities would be required at that time. Demand would then decrease to eight classrooms. In Wells, the demand for classrooms would increase from three for peak construction to 10 for operation workforce.

Law Enforcement. This alternative would result in the largest demand for police protection. Elko would require an estimated 1.5, 2.3, and 1.5 additional officers in 1993, 2000, and 2010, respectively, to accommodate project-related population demands. Additional vehicles would also be required. It is unlikely that Wells would need to hire additional officers because of the existing high level-of-service.

Fire Protection. Impacts from this alternative are similar to those under the Moor Summit, construction-worker camp alternative. However, Wells could need to recruit one or two volunteers by 2000 to accommodate the peak total workforce.

Medical Care. This alternative would result in the highest demand for medical service in Elko and Wells (Table 5.11-16) associated with power plant inmigrants, but the impacts would be approximately the same as with the proposed action.

Water Supply. This alternative would result in a population increase of 5 to 10 percent in Elko and 11 to 32 percent in Wells over current population. Impacts to the water system would be similar to the impacts under the proposed action.

Sewer Supply. This alternative would result in the highest demand for sewer service in Elko and Wells. The conclusions regarding impacts would be the same as for the no construction-worker camp alternative.

Table 5.11-15. PROJECTED HOUSING NEEDS IN ELKO AND WELLS FOR THE MOOR SUMMIT, NO CONSTRUCTION-WORKER CAMP ALTERNATIVE[a]

	Elko Current Housing Stock	Housing Needs Elko		Wells Current Housing Stock	Housing Needs Wells	
		Number	% of Current		Number	% of Current
Peak Construction (Year 1993)	5200	311-497	6-10	500	63-101	13-20
Peak Workforce (Year 2000)	5200	462-648	9-12	500	141-179	28-36
Operation Workforce (Year 2010)	5200	284	3	500	147	29

[a] Range is for average construction workforce of 500 and peak construction workforce of 805.

Table 5.11-16. PROJECTED SERVICE DEMANDS ASSOCIATED WITH NON-PROJECT-RELATED AND PROJECT-RELATED GROWTH IN ELKO AND WELLS FOR THE MOOR SUMMIT, NO CONSTRUCTION-WORKER CAMP ALTERNATIVE

	Elko				Wells			
	Existing	1993	2000	2010	Existing	1993	2000	2010
Housing (units)	5200				500			
Demand of growth		1000	2700	6150		30	80	160
Project-related demand (average construction workforce)		311	462	284		63	141	147
School Enrollment (students)	4995				432			
Additional enrollment		956	2341	5278		26	67	133
Project-related enrollment (average)		135	232	185		28	79	96
Demand for classrooms		38	93	212		3	7	14
Project-related classrooms (average)		6	10	8		3	8	10
Law Enforcement (officers)	31				5			
Demand of growth		6	17	41		0	0	0
Project-related officers		1.5	2.3	1.5		0	0	0
Fire Protection (workers)	20				15			
Demand of growth		2.0	5.4	12.3		0.4	1.0	1.9
Project-related demand		0.6	0.9	0.6		0.8	1.7	1.8
Medical Care (doctors)	16[a]				1			
Demand of growth		3.3	9.0	20.3		0.1	0.2	0.5
Project-related demand		0.7	1.1	0.8		0.0	0.4	0.4

[a] The number of doctors in Elko County is not sufficient to accommodate existing demand. Elko County needs to hire nine doctors to be at a typical service ratio.

Solid Waste Disposal. This alternative would result in the highest solid waste disposal demand in Elko and Wells. The conclusions regarding potential impacts are the same as those with the no construction-worker camp alternative.

Library. The library usage under this alternative would be similar to that under the no construction-worker camp alternative except that the West Wendover branch would also be utilized. The Elko County library system would have more use because all workers would live in the county.

Public Finance. The need for additional community services to be supplied would be greater than those needed with the proposed action. This would include four classrooms in Elko and two classrooms in Wells by 1993, six classrooms in Elko and five classrooms in Wells by 2000, four classrooms in Elko and six classroom in Wells by 2010, and two police officers in Elko by 2000. Tax revenues generated by construction of the proposed power plant would be identical to those generated under the proposed action.

Social Conditions

City of Elko. With this alternative, the City of Elko would receive a greater, fluctuating influx of construction workers and their families in the short term than they would with the Moor Summit, construction-worker camp alternative. However, the long-term, permanent resident increase would be similar to the Moor Summit, construction-worker camp alternative and would result in similar effects to social structure and well-being.

City of Wells. The fluctuating population increase anticipated in the City of Wells would be greater with this alternative than with the Moor Summit, construction-worker camp alternative. In addition, the magnitude of increase is greater than that with the proposed access road, no construction-worker camp alternative. This would result in even greater stresses to the social structure and well-being.

Other Potentially Affected Communities. The effects to Wendover under this alternative would be of a greater magnitude than all of the other alternatives. Table 5.11-17 presents the anticipated increase in population and school-aged children. The population increases range from 3 to 7 percent in the years analyzed.

Conclusions regarding availability of services would be the same as those for the Moor Summit, construction-worker camp alternative (Section 5.11.2.2). Twin Falls and Jackpot would not be affected under this alternative.

5.11.3 SENSITIVITY ANALYSIS

This section discusses the sensitivity of the socioeconomic analysis to the assumptions used for four variables: the schedule of construction, the peak workforce, the level of projected mining activity in Elko, and the maximum commute distance.

Table 5.11-17. PROJECTED INCREASE IN POPULATION IN WENDOVER FOR THE MOOR SUMMIT, NO CONSTRUCTION-WORKER CAMP ALTERNATIVE[a]

Year	1993	2000	2010
Number of Workers	76-122	121-167	76
Number of School-Aged Children	33-53	59-79	49
Total Population Increase	182-292	290-400	204
Projected Population of Communities Without Project	4363	5132	5791
Project-Related Population as Percent of Total Population	4-6	5-7	3

[a] Range is for average construction workforce of 500 and peak construction workforce of 800.

5.11.3.1 Schedule of Construction

The anticipated schedule of construction is designed with completion of construction of a unit every 2 years. This schedule creates a relatively steady construction workforce, due to the overlap of schedules between two units. The construction workforce varies between 325 and 805 (Table A-1 in Appendix A). The schedule would be driven by the demand for the produced energy. If the demand for energy slowed, the completion of construction of the units could be farther apart, removing the overlap of the workforces associated with each unit. This would reduce the anticipated peak construction workforce to 717, but would also reduce the lower end of the workforce to 0, 70, or 150 workers, depending on the number of years between construction of the units (5, 4, and 3 years, respectively).

This more extreme fluctuation in construction workforce would create a cyclical demand for community services, increasing the difficulty in providing these services. The principal impacts would be to services such as schools, fire protection, law enforcement, and medical care. The staffing requirements for these services would increase and decrease cyclically over time. The communities would have to decide whether to hire and fire teachers, firefighters, policemen, etc., as need dictated, to accept deficit service during the peak workforce periods, or to pay for extra service during the low workforce periods. For other services, such as utilities, the low employment periods would result in lower utilization of the facilities, which would not be a significant impact.

In addition to the fluctuating service demand associated with the extended schedule, the revenues associated with sale and use tax on construction materials, and spending of salaries in the area would also fluctuate to a greater degree. The lack of stability in revenues could create difficulties for the local jurisdictions during budgetary planning.

5.11.3.2 Peak Workforce

The anticipated peak construction workforce is 805. During the case studies conducted by the Electric Power Research Institute on 12 power plants, it was found that the actual peak was an average of 173 percent of the projected peak employment (EPRI 1982). The report stated that the most common cause of differences between actual and peak employment was delay in construction startup, and subsequent use of double shifts to make up time. Common sources of delay were:

- Regulatory delays
- Subcontractor performance and material delivery delays
- Weather delays
- Strikes and work stoppages
- Engineering, design and retrofit delays
- Competition for construction labor (EPRI 1982)

The actual peak employment at Valmy Unit I was 113 percent of the projected peak. The peak employment for Unit II was overestimated (97 percent of projected).

For the purpose of this sensitivity analysis, it is assumed that the actual peak of construction workforce is 175 percent of the projected peak of 805. This new hypothetical peak of 1400 workers is used here for further analysis.

Proposed Action. Using the same assumptions described in Appendix A, and assuming full occupation of the construction-worker camp (one worker in each space), the number of immigrating workers would be 704. This results in a population increase of 506 in Elko and 82 in Wells, during peak construction (roughly 4 times the number anticipated throughout the analysis). In actuality, the number of immigrating workers would be less because workers would likely double and triple up in the 300 RV spaces during peak periods. In addition, construction-worker camps in the past have adjusted during peak periods by taking measures such as placing bunk beds in the dormitory rooms. Therefore, it is likely that the number of workers in the construction-worker camp could increase to the point where the number of immigrants to the local communities is similar to the increase with the anticipated workforce schedule. Therefore, impacts to the local communities would be similar.

Proposed Access Road, No Construction-Worker Camp Alternative. Under this analysis scenario, the number of immigrating workers with the proposed access road, no construction-worker camp alternative would be 1260 during peak construction. This would result in a population increase of 1047 in Elko and 169 in Wells, during peak construction.

This can be compared with 532 in Elko and 86 in Wells with the anticipated workforce schedule. This population increase includes an increase of 328 school-aged children in the Elko County School District during the peak summer months, as compared to 126 with the anticipated workforce.

The substantial increase in construction-related population within each of the local communities would exacerbate any difficulties associated with the supply of community services.

Moor Summit Access Road, Construction-Worker Camp Alternative. The number of project-related immigrants would be 1127 to Elko and 229 to Wells. This is roughly 4 times as large as the number anticipated throughout the Moor Summit access road, construction-worker camp alternative analysis.

Moor Summit Access Road, No Construction-Worker Camp Alternative. The number of project-related inmigrants related to peak construction would be 2330 in Elko and 473 in Wells. This can be compared with the anticipated peak of 1184 in Elko and 240 in Wells for the Moor Summit access road, no construction-worker camp alternative.

5.11.3.3 Mining Activity

The demographic conditions and service availability described in the socioeconomic analysis are based on the assumption that the number of mining employees in the Elko and Carlin area will remain constant. This assumption stems from conversations with local officials that have interviewed mining company officials in order to help estimate future population growth in Elko. These mining officials have indicated that mining construction is being completed in Fall 1989 and that as construction workers left the area, additional operation workers will arrive, keeping total mining employees at the current level (Klein 1989).

The validity of the assumption is important considering service availability. The gold market is extremely volatile and is influenced by unpredictable levels such as the world market price of gold. An increase in the price of gold would likely result in increased mine construction in order to increase the rate of production. This would result in a similar mining and population boom in the area to that currently being experienced in Elko and Carlin. If this occurred, service and housing availability would continue to be strained. Power plant workers would have a difficult time settling in Elko and would likely live in higher proportion in the communities of Twin Falls, Jackpot, and Wendover, and the smaller communities of Oasis and Montello, depending on the access road chosen.

It is also possible that the price of gold could drop in the near future, resulting in a decrease in metal production. As the production rate decreased, the number of mine workers seeking housing and services in Elko would also decrease. This would increase availability of services for power plant workers, resulting in a greater ease of settlement in Elko.

5.11.3.4 Maximum Commute Distance

A study indicates that many construction and operation workers would be willing to commute 100 miles each way to the project site (Murdock et al. 1978). Consultation with some local administrators and long-time residents supports the view that many workers would be willing to commute to Elko and Twin Falls (which are at distances of 90 and 98 miles, respectively). If workers are not willing to commute that far, increased pressure would be put on the communities of Wells, Jackpot, and Wendover (the specific distribution depending on the alternative access road and other factors). This would result in greater impacts to housing and community services in these communities and fewer demands in Twin Falls and Elko.

For example, if it is assumed that few workers would commute more than 60 miles, there would be major impacts to service provision and, consequently, social well-being in Wells and Jackpot (with either the proposed access road or the Brush Creek alternative) or Wells (with the Moor Summit access road alternative).

5.11.4 MITIGATION

The socioeconomic impact analysis identifies several significant project-related impacts related to increased population and service demand in Wells. In addition, the impact analysis contains many assumptions that attempt to predict the service conditions in the future, in an area that is undergoing rapid change. It also utilizes assumptions that attempt to predict where construction and operation workers and their families would settle. For these reasons, the following mitigation measures are recommended so that the inmigration of workers to the communities could be accommodated as smoothly as possible.

- If there is a lack of capacity for educational facilities prior to the receipt of project-related revenues, the applicant should partially prepay taxes to Elko County School District to provide needed facilities during the early years of the construction schedule.

- The applicant should prepay taxes so the City of Wells could hire a planner. This planner would facilitate housing development, identify funding sources for city improvements, and apply for funding.

- The applicant should designate a company person to act in a community relations capacity. This person would be available for dissemination of information to the public concerning construction schedule plans, availability of housing, and would also answer questions from the public.

5.12 <u>LAND USE</u>

5.12.1 PROPOSED ACTION

5.12.1.1 <u>Land Acquisition</u>

The proposed land exchange would result in transferring 15,960 acres of selected lands to private ownership in the Toano Draw area, in exchange for the transfer of 12,770 acres of offered lands in the Snake Mountains and 640 acres of offered lands in Toano Draw to Federal ownership.

The exchange of Toano Draw and Snake Mountain lands is consistent with established BLM policies, including the BLM's implementation policy for disposing of lands in "Retention/Management" (R/M) areas while acquiring lands having high public value. The selected lands are in a designated R/M area. Land ownership occurs in a checkerboard pattern which creates management problems for both Federal and private land managers. The offered lands in the Snake Mountains meet the criteria that was developed for "Retention/Consolidation" (R/C) areas and are adjacent to an R/C area.

Eliminating irrigation of pasture and hay lands would necessitate changes in LOS, Inc.'s livestock operations. These changes could include

any or all of three methods of grazing operations as discussed in Section 5.12.1.2. Potential impacts to public lands as a result of these changes would be evaluated and mitigated through the BLM's allotment evaluation and monitoring program.

The land exchange would cause the following changes to the affected grazing permits:

Allotment Name	Change in Grazing Capacity on Public Land (AUMs)
HD	+1216
Hubbard Vineyard	+145
Stormy	+15
Black Butte	+133
Big Springs	*

The selected lands have little or no mineral value with the exception that they are identified as "Prospectively Valuable" for oil and gas. The only other known commodities are low quality sand and gravel.

The offered lands have moderate potential for copper, zinc, gold, silver and other metals. The only material recently mined on the offered lands is barite. However, mineral exploration is expected to continue and modest amounts of surface disturbance would occur as a result of this activity. BLM has no regulatory authority to manage mineral development in a split-estate situation. In addition, to the mineral values identified the lands have also been identified as "Prospectively Valuable for oil and gas."

Access by the public through the selected lands would be retained as a condition of the land exchange.

5.12.1.2 Construction and Operation

The construction activities for the power plant would remove approximately 1780 acres (1240 acres for the plant site, 260 acres for the railroad, 120 acres for the access road) from LOS's grazing operation on the HD allotment. This would cause a slight change in the percent of public land within this allotment by removing approximately 88 AUMs from these lands. The disturbance caused by the water pipeline would not affect the operation because these areas would be reseeded and remain available for livestock grazing.

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* The change in the estimated livestock carrying capacity on the Big Springs allotment is insignificant.

Conversion of water rights on Winecup and Gamble Ranches would eliminate hay production along Thousand Springs Creek, primarily downstream from Crittenden Creek. This action could affect the number of cattle grazing in this area. Once irrigation of hay fields was phased out, grazing on the Winecup and Gamble ranches and other public lands would be done in accordance with existing Dairy Valley, Gamble Individual, and HD Allotment Management Plan (AMP) or at a level mutually agreed upon by BLM. LOS's grazing operations could change in any number of ways. Three possibilities are described below:

1. Purchasing hay from other sources.

2. Changing class or type of livestock operation, i.e., cow/calf to yearling or sheep.

3. Grazing private non-irrigated pasture lands in conjunction with public grazing operation.

Potential impacts to public lands as a result of these changes would be evaluated and mitigated through the BLM's allotment evaluation and monitoring program.

5.12.2 ALTERNATIVES

5.12.2.1 Alternative Access Road Corridors

Moor Summit Access Road. The Moor Summit access road would be constructed with a ROW granted by the BLM. Construction of this alternative would be consistent with the Wells Resource Management Plan (RMP). The access road would cross the Big Springs grazing allotment between the Moor interchange and Fenelon. Approximately 290 acres producing an estimated 26 AUMs would be lost.

Brush Creek Access Road. The Brush Creek access road would be constructed within a ROW granted by the BLM. Construction of this alternative would be consistent with the Wells RMP. Approximately 13 AUMs would be removed from public lands by this alternative.

5.12.2.2 Land Acquisition Alternatives

Rights-of-Way Grants. This alternative would involve granting ROWs for each of the project facilities. This mechanism would be cumbersome for a project of this size. This mechanism would not have the benefit of consolidating high value lands for public use in the Snake Mountains as would the proposed action. Approximately 140 AUMs would be removed from public lands by this alternative. Also, locating a landfill on property that could revert back to Federal management would be against BLM policy.

Selling the Public Lands. The public lands are in an area designated by the BLM as R/M. BLM management policies call for retention of lands within areas designated R/M except for those suited for exchange for private lands. Therefore, selling the public lands in Toano Draw for TSPP would

not be consistent with the BLM land management policy as designated in the RMP. If this alternative were selected, this document would serve as the amendment to the RMP. Approximately 140 AUMs would be removed from public lands by this alternative.

5.12.3 MITIGATION

No mitigation measures are recommended regarding land use, because no significant impacts were identified.

5.13 TRANSPORTATION

5.13.1 PROPOSED ACTION

5.13.1.1 Land Acquisition
Access through the project area would result from the easements that would be granted in association with the land exchange.

5.13.1.2 Construction and Operation
Potential impacts associated with project-related worker traffic, truck traffic, and railroad transportation are described below. It should be noted that the analysis of traffic impacts is different between project-related worker traffic and construction-related heavy truck traffic. Worker traffic results from construction and operation workers driving personal, light-duty vehicles to the job site in the morning hours and returning in the afternoon or evening. This analysis evaluates the potential for this traffic to add to or cause congestion on regional roadways during peak hour conditions. Construction-related truck traffic refers to the larger delivery trucks bringing equipment and construction materials to the job site. These trucks do not significantly affect congestion. However, unlike light-duty automobiles, heavy trucks can contribute to premature roadbed and pavement degradation. Safety and road closures related to adverse weather conditions and impacts to railroads are also addressed.

Construction and Operation Workforce Traffic. With the proposed action, construction workers would live at a construction-worker camp close to the project site, as well as at available housing in the communities of Twin Falls, Jackpot, Elko, and Wells. Based on the analysis of socioeconomic impacts (Sections 5.11.1.2 and 5.11.1.3), a distribution of workers living in these communities was predicted. These workers would drive personal vehicles to and from the site along I-80, Highway 93, and the project access road. To predict impacts to local roads, three project workforce scenarios were evaluated: the peak construction period (1993), when the largest construction workforce is predicted to occur; the peak combined construction and operation workforce period (2000), when construction and operation overlap for the highest combined workforce at the project site; and the peak operation workforce (2010), when the greatest number of operation-related workers would be at the project site.

Table 5.13-1 lists the predicted roadway levels-of-service on I-80 and Highway 93 for each of the three scenarios described above. The level-of-service of a road segment is an indicator of operating conditions and is defined in levels ranging from A to F. Level-of-service A is the least congested, representing free-flow conditions, while Level-of-service F is the most congested, representing forced flow conditions at low speeds, with backup or queuing of vehicles. Table 5.13-2 describes level-of-service categories.

The predictions listed in Table 5.13-1 were based on current traffic data provided by the NDOT (Pray 1989), and were extrapolated for future years based on historical traffic increases. Traffic growth on I-80 shows a steady increase of about 4 percent per year since 1980. On Highway 93, growth in traffic is uneven, with no-growth periods of several years followed by growth spurts of up to 5 or 6 percent, which are probably related to growth and construction in the mining industry. Investigation of mining plans in the region indicated that the high growth periods of recent years associated with this industry are declining (discussed in Section 5.11.1.1). An average growth rate of 2 to 3 percent through 2010 was assumed for this analysis. To predict the level-of-service for each road segment, a maximum peak hour traffic volume (a 1-hour period representing the highest traffic volume for the road) was estimated for future conditions, to which the project-related peak hour traffic was added. The project-related traffic was based on the socioeconomic analysis that predicted the distribution of workers living in the construction-worker camp and the communities of Twin Falls, Jackpot, Wells, and Elko. It was assumed that car-pooling would take place, at a rate of 1.3 occupants per car (FHWA 1977).

Table 5.13-1 shows that the levels-of-service on I-80 would not be affected by the proposed project-related construction and operation worker traffic. With two lanes in each direction, the increase in project-related traffic on I-80 would only be a small portion of the available freeway capacity. The levels-of-service on I-80 would remain at "A" with the proposed action.

The levels-of-service on Highway 93 during the morning and afternoon peak hour periods would be affected by the proposed action. Worker traffic originating from Twin Falls, Jackpot, Elko, and Wells would increase morning and evening peak hour traffic volumes and result in a decrease in level-of-service from A to B. This change would occur at the peak construction and operation period (2000) and during full operation of all units (beginning in 2010). The decline in level-of-service is due to both the lower capacity of Highway 93 (one lane in each direction) than I-80, and the combined project-related worker traffic originating from Twin Falls, Jackpot, Wells, and Elko being highest along this road. A change from level-of-service A to B is not considered a significant impact. Traffic operating conditions would change from free flow at Level-of-service A to stable flow at B, with little change in speed or maneuverability. The effect would only take place during morning and afternoon periods when workers are traveling to or leaving the job site.

Table 5.13-1. TRAFFIC LEVELS-OF-SERVICE[a] FOR PROPOSED ACTION AT PREDICTED PEAK CONSTRUCTION AND OPERATION YEARS (1993, 2000, 2010)

Route/Location	1993	2000	2010
Interstate 80			
East of Elko, West of Halleck	A	A	A
Between Halleck and Deeth	A	A	A
West of Wells	A	A	A
East of Wells	A	A	A
West of Pequop Summit	A	A	A
West of Oasis	A	A	A
U.S. Highway 93			
N. of Contact/S. of Jackpot	A	B	B
South of Contact	A	B	B
North of Wilkins	A	B	B
South of Wilkins	A	B	B

[a] See Table 5.13-1 for explanation of level-of-service categories.

Table 5.13-2. DEFINITIONS OF LEVEL-OF-SERVICE CATEGORIES

Level-of-Service	Definition
A	Free flow; speed controlled by driver's desires, speed limits, or physical roadway conditions.
B	Stable flow; operating speeds beginning to be restricted; little or no restrictions on maneuverability from other vehicles.
C	Stable flow; speeds and maneuverability more closely restricted.
D	Approaches unstable flow; tolerable speeds can be maintained but temporary restrictions to flow cause substantial drops in speed. Little freedom to maneuver; comfort and convenience low.
E	Volumes near capacity; speed typically in neighborhood of 30 mph; flow unstable; stoppages of momentary duration. Ability to maneuver severely limited.
F	Forced flow; low operating speeds, volumes below capacity; queues formed.

Truck Traffic. Construction equipment and materials would be transported to the site by trucks and railroad. The heaviest equipment and material loads, such as generators, boilers, and some structural materials, would be transported to the site via the railroad spur, thus avoiding the impact of transporting these materials by truck. Preliminary estimates for equipment and material transport indicate that about 8000 truck trips would be needed for construction of the first power plant unit and about 7000 truck trips for construction of each subsequent unit. Given a construction schedule of about 34 months (at 5 days per week) for each power plant unit and considering that construction (and the associated hauling of equipment and materials) could be temporarily slowed or delayed during winter months, approximately 10 to 15 trucks per day on average would be traveling to and from the project site. Any trucks carrying equipment or materials to the site would have to meet state and Federal weight and size restrictions.

Truck weight and the type and size of trucks using a road can affect pavement and roadway maintenance. Roads are designed structurally to accommodate predicted volumes of truck traffic; high volumes of truck traffic require roads with deeper or stronger subgrade materials, and thick or strengthened pavement. Within the project region, I-80 is designed for considerable growth in traffic and trucks through the use of portland cement surfacing and strengthened or deep subgrade foundations (Cress 1989; Pray 1989). This freeway can accommodate large volumes of interstate commerce truck traffic with minimal pavement or structural fatigue. I-80 would not be expected to be impacted by truck traffic associated with the project.

The origin of power plant equipment and materials is unknown at this time, but is expected to come from local suppliers as well as from California, the Pacific Northwest, and sources to the east. With the proposed access road connecting to Highway 93, truck traffic would use I-80 and Highway 93 for access to the project site; that is, trucks from California, Nevada, and Utah would use I-80 and head north on Highway 93, while trucks from Idaho would head south on Highway 93, passing through (or originating from) Twin Falls and Jackpot.

Truck traffic on Highway 93 would increase by an average of up to 10 to 15 trucks per day. Current truck volume on Highway 93 is about 28 percent of the total vehicle volume, or about 375 to 450 trucks per day between Wells and Contact. The project would increase this truck volume by about 2 to 4 percent. This increase alone would not cause a significant impact to the life expectancy of Highway 93 pavement. However, it would contribute to the overall growth in vehicle and truck volumes on this route, adding to a potential cumulative impact.

Safety and Road Closures. Construction of the project may be subject to temporary shutdown or slowdown at least several days of the year due to adverse weather conditions. During snowstorms, it would be expected that the access road would be most subject to closure since it would have a lower priority for snow removal than I-80 or Highway 93.

Rail Traffic. A railroad spur from the Southern Pacific Railroad (SPRR) to the project site would be constructed to transport construction materials and equipment, as well as coal, during operation. This would avoid the transport of these materials by truck over regional roads, thereby avoiding roadway transportation impacts. It is anticipated that operation of the project would result in approximately five unit trains per day carrying coal to the project site. Typical train traffic between Ogden, Utah and Elko, Nevada, between Granger, Wyoming, and Ogden and between Colton, Utah, and Ogden is summarized in Table 5.13-3. The time required (in minutes) for existing train traffic to pass a stationary point along each of the three legs is also presented in Table 5.13-3. The proposed coal train originating at the Kemmerer Mine, approximately 6600 feet/120 cars in length, would increase traffic along the Granger-to-Ogden, and Ogden-to-Elko legs by two to three trains per day and each train would require 1.88 minutes to pass a stationary point. The proposed trains from the Scofield Mine, approximately 5720 feet/104 cars in length, would also increase traffic along the Colton-to-Ogden, and Ogden-to-Elko legs by two to three trains per day, and each train would require 1.62 minutes to pass a stationary point. As the proposed coal unit trains traveled the Ogden-to-Elko leg, a net increase of four to five trains and approximately 7 to 10-1/2 minutes per day of additional traffic would occur along that portion of the proposed route.

5.13.2 ALTERNATIVES

5.13.2.1 Land Acquisition Alternatives

Under the alternative of a public sale, easements would be granted across the private parcels in Toano Draw as described in the proposed action to provide for continued public access through the project area.

5.13.2.2 Alternative Access Road and Construction-Worker Camp Accommodations Levels of Service. Tables 5.13-4, 5.13-5 and 5.13-6 list traffic levels of service with the alternatives in comparison to the proposed action.

The Brush Creek alternative access road would have the same traffic operational impacts as the proposed access road. The alternative access road at Moor Summit would result in no changes in level-of-service on regional roads. It was assumed that all workers not residing in the construction-worker camp would live in Elko, Wells, and Wendover. All construction and operation worker traffic would be on I-80, which has adequate capacity and would not be measurably affected by the additional traffic.

The alternative of a no construction-worker camp, with the proposed access road connecting with Highway 93, would result in greater traffic volumes on Highway 93 and I-80 and lower levels-of-service on Highway 93, in comparison to the proposed action. This results from workers, who under the proposed action would live at the on-site construction-worker camp and would not commute on existing highways, instead all living in Twin Falls, Jackpot, Wells, and Elko and commuting to the project site.

Table 5.13-3. EXISTING AND PROPOSED TRAIN TRAFFIC

Existing Traffic	Frequency Per Day	Average Length (Feet)	SPD (RPH)	Duration (Minutes)
Ogden to Elko[a]				
Southern Pacific	12	5000	55	12.4
Union Pacific	5	5000	55	5.2
Chicago Passenger	1	5000	65	0.9
Granger to Ogden[b]				
Union Pacific	20	6000	50	27.3
Colton to Ogden[c]				
Denver and Rio Grande	10	6000	50	13.6
PROPOSED TRAFFIC				
Train A (Kemmerer)	2 to 3	6600	40	3.7 to 5.6
Train B (Scofield)	2 to 3	5720	40	3.2 to 4.9

a Provided by Hank Jay, Chief Train Dispatcher, Transportation Department, Southern Pacific.

b Provided by Rick Brown, Public Relations Department, Union Pacific, Omaha.

c Provided by Dispatcher 5, Denver and Rio Grande, Denver.

Table 5.13-4. TRAFFIC LEVELS-OF-SERVICE[a] FOR ALTERNATIVES AT PREDICTED PEAK CONSTRUCTION PERIOD (YEAR 1993)

Route/Location	Wilkins[b]/Brush Creek Access		Moor Summit Access		No Action Alternative
	With Construction-Worker Camp[b]	No Construction-Worker Camp	With Construction-Worker Camp	No Construction-Worker Camp	
Interstate 80					
East of Elko, West of Halleck	A	A	A	A	A
Between Halleck and Deeth	A	A	A	A	A
West of Wells	A	A	A	A	A
East of Wells	A	A	A	A	A
West of Pequop Summit	A	A	A	A	A
West of Oasis	A	A	A	A	A
U.S. Highway 93					
N. of Contact/S. of Jackpot	A	B	A	A	A
South of Contact	A	B	A	A	A
North of Wilkins	A	B	A	A	A
South of Wilkins	A	B	A	A	A

[a] See Table 5.13-1 for explanation of level-of-service categories.

[b] Proposed action.

Table 5.13-5. TRAFFIC LEVELS-OF-SERVICE[a] FOR ALTERNATIVES AT PREDICTED PEAK CONSTRUCTION AND OPERATION PERIOD (YEAR 2000)

Route/Location	Wilkins[b]/Brush Creek Access		Moor Summit Access		No Action Alternative
	With Construction-Worker Camp[b]	No Construction-Worker Camp	With Construction-Worker Camp	No Construction-Worker Camp	
Interstate 80					
East of Elko, West of Halleck	A	A	A	A	A
Between Halleck and Deeth	A	A	A	A	A
West of Wells	A	A	A	A	A
East of Wells	A	A	A	A	A
West of Pequop Summit	A	A	A	A	A
West of Oasis	A	A	A	A	A
U.S. Highway 93					
N. of Contact/S. of Jackpot	B	C	A	A	A
South of Contact	B	C	A	A	A
North of Wilkins	B	B-C	A	A	A
South of Wilkins	B	B	A	A	A

[a] See Table 5.13-1 for explanation of level-of-service categories.

[b] Proposed action.

Table 5.13-6. TRAFFIC LEVELS-OF-SERVICE[a] FOR ALTERNATIVES AT PREDICTED FULL OPERATION PERIOD (YEAR 2010)

Route/Location	Wilkins[b]/ Brush Creek	Moor Summit	No Action Alternative
Interstate 80			
East of Elko, West of Halleck	A	A	A
Between Halleck and Deeth	A	A	A
West of Wells	A	A	A
West of Pequop Summit	A	A	A
West of Oasis	A	A	A
U.S. Highway 93			
N. of Contact/S. of Jackpot	B	A	A
South of Contact	B	A	A
North of Wilkins	B	A	A
South of Wilkins	B	A	A

[a] See Table 5.13-1 for explanation of level-of-service categories.

[b] Proposed action.

Truck Traffic. The Moor Summit Alternative access road would connect with I-80 and could reduce the number of trucks contributing to Highway 93 traffic. Delivery trucks originating from California, Nevada, and Utah that use I-80 would avoid having to travel on Highway 93. However, those trucks originating from or traveling through Idaho would still use Highway 93 to connect with I-80 and the Moor Summit access road. This alternative would, therefore, reduce but not eliminate the project's contribution to truck traffic on Highway 93. Because of the uncertainty at this time in the origin of construction materials for the project, the extent of this impact for the proposed project or alternatives cannot be determined.

Safety and Road Closure. The Moor Summit access road would be subject to slightly more severe winter weather conditions than the proposed Wilkins access road. The Wilkins access road is at approximately a 5500-foot elevation, and the Moor Summit access road would be at an elevation of 5500 to 6200 feet. The longer length of the Moor Summit road (10 miles longer than the Wilkins road) increases the amount of snow clearance required to keep the road open during winter months.

5.13.3 MITIGATION

No significant impacts have been identified for traffic and transportation. However, to minimize the additional volume of traffic on regional roads resulting from construction and operation workers driving to and from the site, measures should be implemented by the project applicant to induce car-pooling or sharing.

The following mitigation measures are recommended to provide incentives to car pool:

- The applicant should require that contractors and unions involved with the construction and operation of the project encourage car-pooling among their employees and/or members.

- The applicant should encourage workers to post their home locations, so that co-workers living in the same community or neighborhood can be identified.

Busing workers to and from the project site would help minimize project-related traffic impacts. It is expected that staggering of workshifts would occur. The construction and operation workers would have slightly staggered workshifts because of their different working lengths. The operation workforce would be divided into three different workshifts within a 24-hour period. The construction and operation workforce with shifts starting and ending at different times would also reduce the level of project-related traffic on the road at one time.

An analysis of the effectiveness of the mitigation measures was made using increased car occupancy rates that might be reasonably expected to

occur with this project or could be achieved through implementation of the measures recommended above. The analysis assumed an increase in the car occupancy rate from 1.3 (used in this analysis) to 1.8 occupants per car. Table 5.13-7 shows the possible effectiveness of the mitigation measures when applied to the proposed action and alternatives. With this rate, levels-of-service on Highway 93 south of Wilkins/North of Wells would improve slightly.

To promote vehicle safety, project-related vehicles on the road during inclement weather should be avoided or minimized. When the access road is open and adverse road conditions persist, the project applicant should reschedule deliveries of equipment and materials to the extent possible to avoid having trucks on regional roads during potentially unsafe conditions.

Approval of an encroachment permit by the NDOT would be required for any work within a state highway ROW, such as the connection of the access road to Highway 93 (or an I-80 interchange for the alternative Moor Summit road). The geometric configuration of the access road connection to Highway 93 would be reviewed by NDOT during consideration of the encroachment permit. The need for left and/or right turn lanes to separate turning traffic from through traffic would be defined and required as needed as part of the encroachment permit.

5.14 NO ACTION ALTERNATIVE

The purpose of the analysis of the no action alternative is to provide a benchmark, enabling decision-makers to compare the magnitude of environmental effects of the proposed action and project component alternatives with the no action alternative.

The no action alternative would result in no power plant construction at the proposed project site. If power needs identified by the applicant are met by other fossil-fuel-burning electric generation facilities, it is likely that air quality impacts would be similar to the proposed action although in other air basins. If these power needs are met by non-fossil-fuel-burning electric generation facilities, then it is likely that air quality impacts would be less than those predicted for the proposed action but other types of impacts could be greater (e.g., water resources, land use, health risk, etc.). Current land use could continue, i.e., livestock grazing and improved pasture and hay production on irrigated lands. Water used for power plant operation would be used instead for irrigation of hay meadows, or would remain as recharge to groundwater supplies. The population in the area would continue to be affected by gold mining in the Carlin trend. There would be no additional demand for community services associated with the power plant. Planned improvements to the services would occur regardless of whether or not the power plant was built. Tax revenues associated with the power plant would not be generated for Elko County and the State of Nevada.

Table 5.13-7. TRAFFIC LEVELS-OF-SERVICE WITH PROPOSED MITIGATION MEASURES[a]

Route/Location	Wilkins[b]/Brush Creek Access: With Construction-Worker Camp[b]	Wilkins[b]/Brush Creek Access: No Construction-Worker Camp	Moor Summit Access: With Construction-Worker Camp	Moor Summit Access: No Construction-Worker Camp	No Action Alternative
Interstate 80					
East of Elko, West of Halleck	A	A	A	A	A
Between Halleck and Deeth	A	A	A	A	A
West of Wells	A	A	A	A	A
West of Pequop Summit	A	A	A	A	A
West of Oasis	A	A	A	A	A
U.S. Highway 93					
N. of Contact/S. of Jackpot	B	B-C[c]	A	A	A
South of Contact	B	B-C[c]	A	A	A
North of Wilkins	B	B-C	A	A	A
South of Wilkins	A[c]	B	A	A	A

[a] At worst-case period of peak construction and operation workforce (2000); see Table 5.13-2 for explanation of level-of-service categories.

[b] Proposed action.

[c] These service levels improve slightly with increased car-pooling.

5.15 POSSIBLE CONFLICTS BETWEEN THE PROPOSED ACTION AND FEDERAL, STATE, AND LOCAL LAND USE PLANS AND POLICIES

The proposed TSPP project would be consistent with Federal, Nevada, and Elko County land use plans and policies. The proposed TSPP project also would be in compliance with the Clean Air Act by not exceeding any National Ambient Air Quality Standards. The proposed project must also be in compliance with the Prevention of Significant Deterioration (PSD) regulations and must meet the NSPS. The PSD regulations require that air quality related values, including visibility, must be evaluated for all Class I areas within 60 miles of the project site. Limits of acceptable change for air quality may not be exceeded for Class I areas. Jarbidge Wilderness Area is a Class I area located approximately 45 miles from the project site.

5.16 CUMULATIVE IMPACTS

The term "cumulative impacts" refers to the concept that the various environmental effects of two or more projects, when considered together, may compound or increase environmental impacts beyond what would be expected if each project were considered separately. Cumulative impacts can include the combined effect of specific, defined projects/actions which are planned, projected, or otherwise reasonably foreseeable in the project study area. They can also include the cumulative changes in the environment that may take place from foreseeable population or economic growth, or regional changes in the environment, to which a proposed project/action may add incremental impacts.

As discussed in the introduction to Section 4.0, the potential for reasonably foreseeable future projects/actions to occur in the time frame of the proposed TSPP project was investigated. Section 5.16.1 describes how the relevant projects/actions were identified and investigated. Section 5.16.2 describes the potential cumulative environmental impacts that may occur, if the proposed TSPP project and the other identified projects/actions proceed as planned. Section 5.16.3 describes the potential cumulative environmental impacts that may occur, if the electric power transmission facilities for the proposed TSPP project and other identified projects/actions proceed as planned.

5.16.1 IDENTIFICATION OF PROJECTS/ACTIONS WITH CUMULATIVE IMPACTS

The identification of relevant projects/actions was conducted using a formal process to minimize ungrounded speculation (since it is not possible to accurately predict specific future decisions or developments). The process used here included four sequential steps, which are discussed below:

- Step 1--Define the time frame for the analysis.

- Step 2--Identify reasonably foreseeable future projects/actions which may occur within the defined time frame.

- Step 3--Consider the zones of influence of the environmental effects for each identified project/action.

- Step 4--Designate the projects/actions and their respective cumulative environmental impacts.

The following paragraphs describe how this four-step process was used to identify the projects/actions discussed in Sections 5.16.2 and 5.16.3.

5.16.1.1 Step 1--Define Time Frame for Analysis

The proposed TSPP project is planned to begin construction in 1991, to be constructed in stages and be completed in 2008, and to operate for a period of approximately 35 years. The proposed TSPP project can be expected to have some environmental effects at any time during this period. Therefore, the time frame for the analysis of potential cumulative impacts was defined as extending from 1991 through 2043.

5.16.1.2 Step 2--Identify Reasonably Foreseeable Future Projects/Actions

This step consisted of reviewing the status of various projects, public agency programs, and other actions that presently exist, or are formally approved, or are actively involved in a formal public review process. It is necessary to establish such criteria to prevent the cumulative impact analysis from becoming so speculative that it would not serve the reviewers' purpose (nor would it comply with Federal requirements).

The following projects/actions were identified and judged to be relevant to this assessment of cumulative environmental impacts:

- The Southwest Intertie Project. This is a proposed major electric power transmission line that would run in a north-south corridor adjacent to the TSPP site. This intertie project has been formally proposed and is under active environmental review by the BLM and other state and Federal agencies.

- White Pine Power Project. This 1500-MW coal-fired power plant project and associated transmission facilities was proposed to be built in Steptoe Valley, in White Pine County, Nevada (48 miles north of Ely). It was originally proposed by White Pine County, Sierra Pacific Power Company, and Nevada Power Company. The proposed project was evaluated in a BLM EIS (dated 1984) and obtained necessary air quality permits from state and Federal agencies. However, for a variety of economic and other reasons, the project has not been built and its PSD permit has expired. There have been recent indications that the White Pine Power Project may be revived in the foreseeable future. If that should occur, it would be necessary to review updated proposals and existing documentation to determine if changes to the proposed

action and/or environmental setting have occurred. It would also be necessary to re-evaluate the air pollution control system in the context of current "Best Available Control Technology" requirements. It may also be necessary to apply for certain other environmental permits and approvals (including a PSD permit). These environmental studies and permitting actions would consider the TSPP project in their cumulative impact analyses. The White Pine Power Project does not actually meet the above-cited criteria (i.e., it is not presently permitted and is not under formal review for permitting actions). However, it is a large project that is well-known in the vicinity, and it does warrant consideration in this EIS. Because certain of the data that are presently available for its probable air pollutant emissions may not be applicable any longer, its air quality impacts could not be considered in a detailed, quantitative manner in this cumulative impact analysis.

- Harry Allen Station. This proposed 2240-MW coal-fired power plant in southern Nevada was the subject of considerable environmental analysis and review in the late 1970s. In recent times there have been indications of renewed interest in that project as well. It does not fully meet the criteria for being a reasonably foreseeable future project/action, but it was included in the cumulative impact analysis because of its size.

- Moapa Power Project. This 100-MW natural gas-fired cogeneration facility is proposed by the Moapa Power Associates. It is located on the Moapa Indian Reservation, approximately 40 miles northeast of Las Vegas, Nevada. Construction is anticipated to begin in July 1990. The BLM is currently evaluating whether to prepare an Environmental Assessment or an Environmental Impact Statement.

- New gold mining projects which are expected to be developed in the area north of Crittenden Reservoir. There is presently a high degree of activity on approximately 15 prospective sites located in a zone which extends from approximately 18 miles to 30 miles north of the TSPP site. The exploration activities are proceeding under permits from the BLM, and it is anticipated that one or more of the projects may develop into a successful gold mining operation. However, at present, no mine proposals have been submitted to the BLM, and it is not yet possible to accurately predict the character, the scale, or the timing of possible future gold mining operations. In order to assess cumulative impacts with gold mining projects in the area, a hypothetical mining project is assumed, similar to the one described and analyzed in the Mother Lode Environmental Assessment (BLM 1989). A medium-sized gold mining project, utilizing approximately 100 construction workers and 75 operation workers. Water use is assumed to be approximately 400 ac-ft/yr at an average of 250 gpm. This gold mine is assumed to be located 18 to 30 miles north of the TSPP project site.

The following were considered but were not judged to be reasonably foreseeable future projects/actions, because they do not meet the above criteria:

- Barite mining activities in the Snake Mountains. It is recognized that there are significant deposits of barite which could be mined in the vicinity to the west of the TSPP project site. However, given the present and foreseeable future market conditions for barite (and the products it is manufactured into), it would be inappropriately speculative to predict either the scale or the timing of new construction, mine development, or new or resumed mining activities that might be proposed. If and when specific plans for such activities are formally proposed to the BLM and other public agencies for their review and/or approval, the cumulative environmental impacts of the mines and TSPP impacts can be evaluated.

5.16.1.3 <u>Step 3--Consider Zones of Influence of Environmental Effects</u>

The zones of influence of each project's environmental effects were considered. This was done to determine the geographic areas where cumulative impacts might occur (i.e., within the areas where the zones might overlap). This was done for each technical subject covered in the EIS, each of which has a different zone of influence. For example, for each given project, noise impacts, socioeconomic impacts, and air quality impacts would occur within different zones of influence. These zones may overlap to some extent, but their respective configurations and geographic extents would be quite different on a map.

In this analysis, the zones of impact for each technical subject (e.g., noise, socioeconomic, air quality) were considered for the proposed TSPP and the cumulative projects. Where the zones of influence for a given subject were judged to be likely to overlap (if all projects proceed simultaneously), those areas were defined as having cumulative impacts. Where there would be no overlap of zones, there would be no cumulative impacts. Resource topics where no cumulative impacts were identified include Geologic Considerations and Water Resources and therefore are not discussed in this section.

5.16.1.4 <u>Step 4--Designate the Projects/Actions and their Respective Cumulative Impacts</u>

The above-described process was used to focus the attention of this EIS section on potential cumulative environmental impacts for the following projects/actions:

- The proposed TSPP project itself

- New electric power transmission facilities that would carry power from the TSPP project

- The proposed Southwest Intertie Project transmission line

- The two large-scale coal-fired power plants that were previously proposed near Ely and near Las Vegas (White Pine Power Project and Harry Allen Station, respectively)

- A hypothetical, medium-sized gold mining project

Project-related cumulative impacts associated with the land transfer, construction and operation of the proposed TSPP project, and related transmission lines are discussed below in Section 5.16.2. Although the development and operation of new off-site transmission system facilities are not part of the proposed action, they are considered to be a foreseeable result of implementing this proposed action, and are therefore considered here for potential cumulative impacts (in Section 5.16.3).

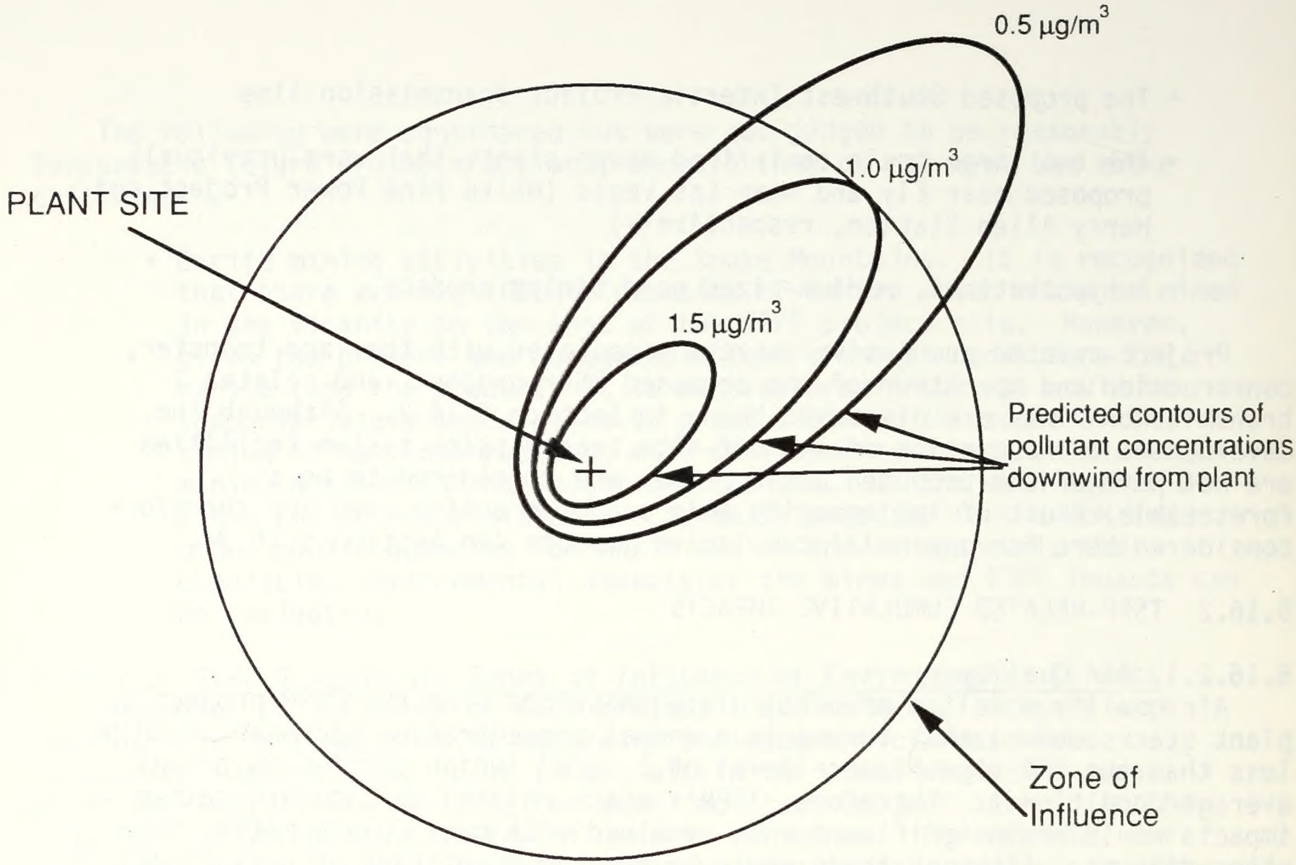
5.16.2 TSPP-RELATED CUMULATIVE IMPACTS

5.16.2.1 Air Quality

Air quality modeling of particulate emissions from the TSPP project's plant stacks showed that the maximum annual concentration increase would be less than the EPA significance level of 1 $\mu g/m^3$ (which applies to annual average conditions). Therefore, TSPP's stack-related particulate matter impacts would be insignificant when combined with particulate matter from other sources. Although there would be greater quantities of particulate matter emitted from fugitive sources at TSPP (i.e., greater than the stack emissions), concentration increases from those fugitive sources would be localized in nature, primarily because of the low release heights. For this reason, their impacts would occur in zones of influence that would be too small to overlap with the impacts from other sources.

The cumulative SO_2 and NO_2 impacts of the proposed TSPP and other proposed or permitted major sources located in Nevada and western Utah were assessed as follows. Air quality impacts from the major sources were estimated using the EPA-approved ISC dispersion model. Conservative meteorological assumptions were used. For wind, joint frequency distributions were used, employing data from the airports nearest to the respective sources. For each major source, the emissions and stack parameters given in Table 4.1-6 were modeled to determine their respective zones of influence. These zones were defined as circular areas whose radii are determined by the maximum extent of the 1 $\mu g/m^3$ modeled concentration contour for SO_2 or NO_2 (Figure 5.16-1). Concentrations less than this value would be below the EPA significance levels and are considered (in this cumulative impact assessment) as not contributing to violations of air quality increments or standards.

Figures 5.16-2 and 5.16-3 and Tables 5.16-1 and 5.16-2 show the modeled zones of influence for the proposed TSPP and each of the major sources assessed for their annual effects. As shown, the TSPP's zone does not overlap with any of the other zones; therefore, on an annual average basis,



Note: The Zones of Influence are plotted to encompass the maximum extent of the plume which could have a pollutant concentration equal to EPA's significance level. (The annual average significance level of 1.0 $\mu g/m^3$ is depicted above as an example).

Figure 5.16-1. GRAPHICAL EXPLANATION OF ZONES OF INFLUENCE FOR AIR POLLUTANTS

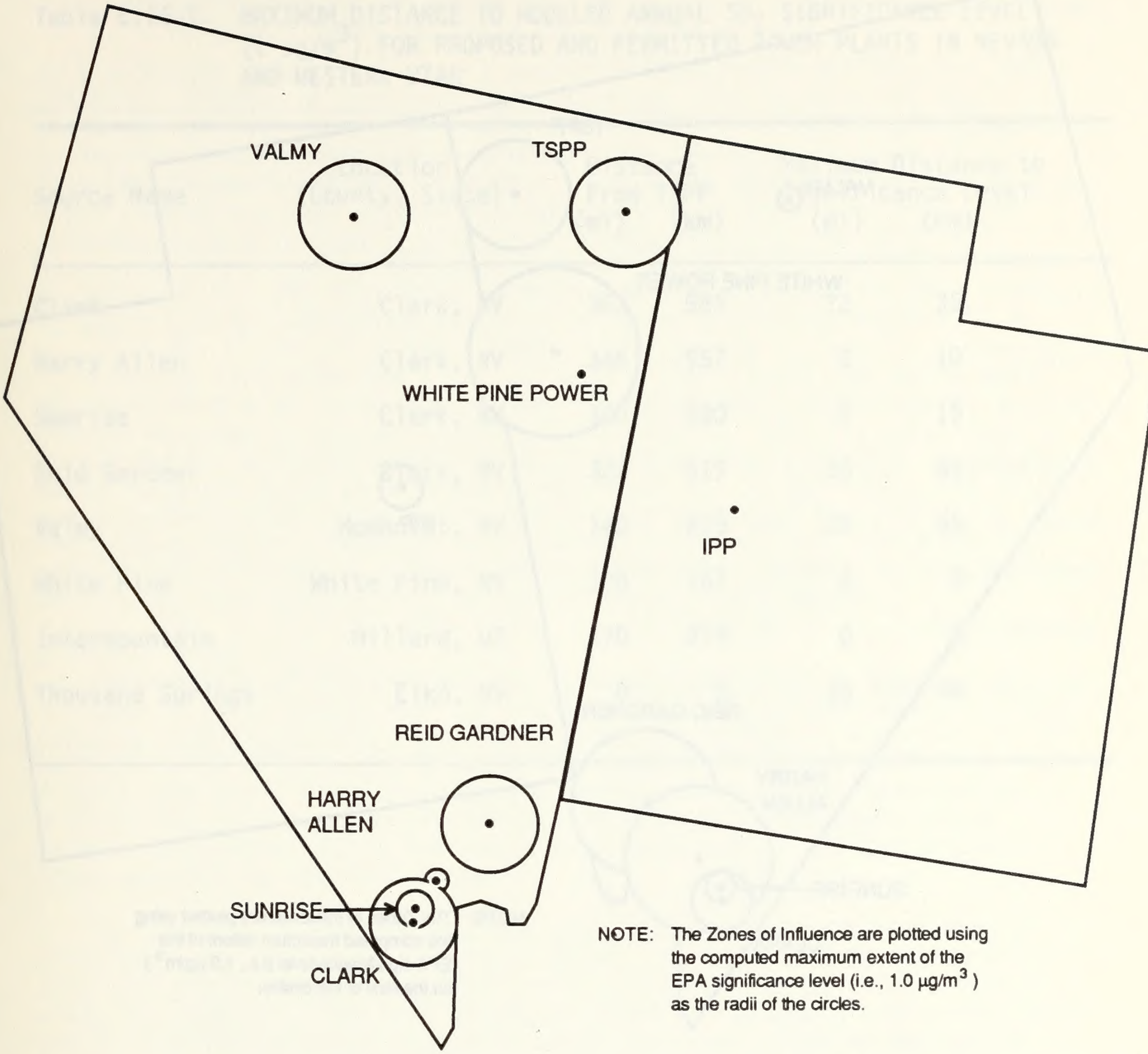
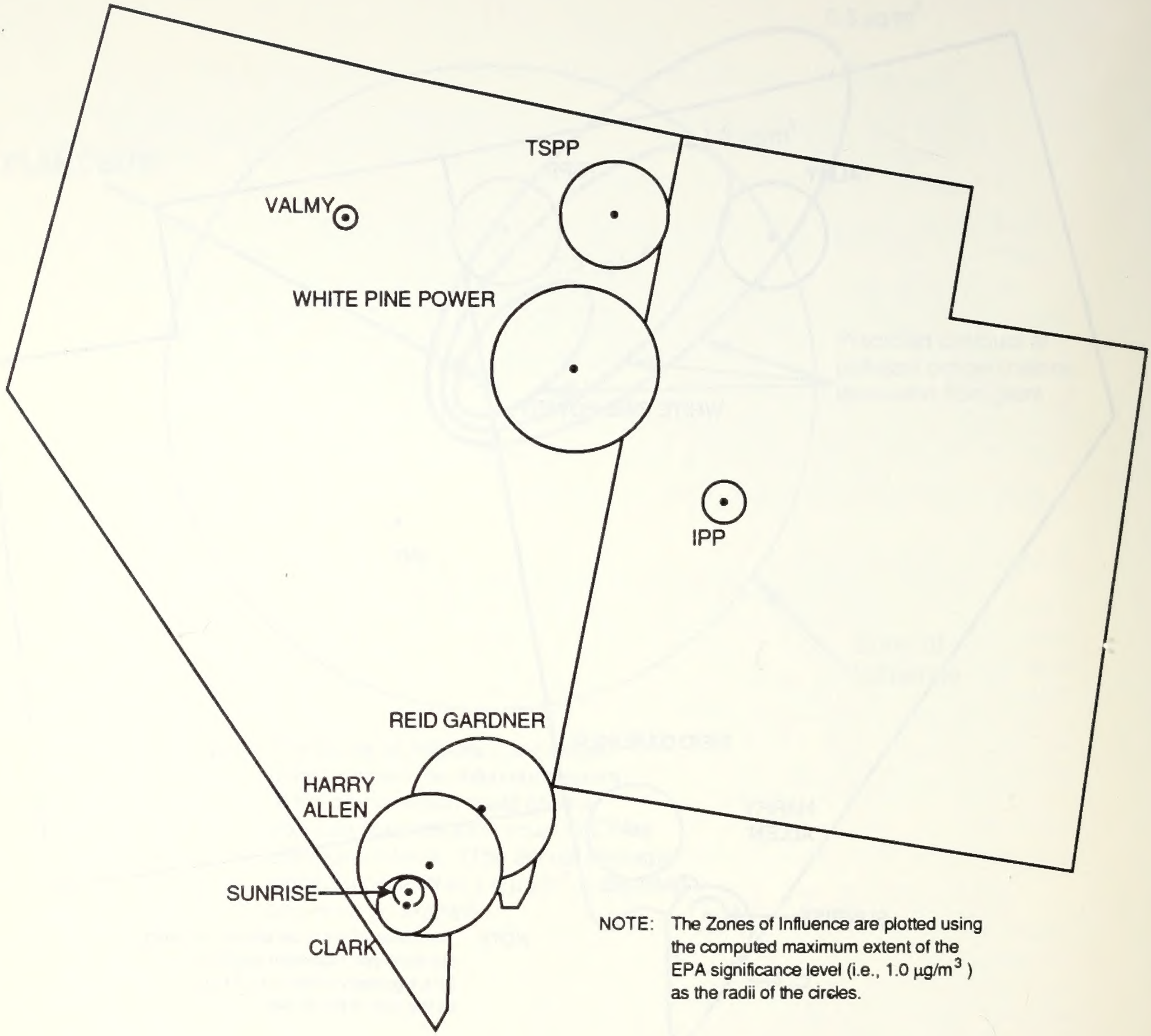


FIGURE 5.16-2. ZONES OF INFLUENCE FOR SO_2 EFFECTS - ANNUAL AVERAGE CONDITIONS



NOTE: The Zones of Influence are plotted using the computed maximum extent of the EPA significance level (i.e., 1.0 μg/m³) as the radii of the circles.

FIGURE 5.16-3. ZONES OF INFLUENCE FOR NO_2 EFFECTS - ANNUAL AVERAGE CONDITIONS

Table 5.16-1. MAXIMUM DISTANCE TO MODELED ANNUAL SO_2 SIGNIFICANCE LEVEL ($1\ \mu g/m^3$) FOR PROPOSED AND PERMITTED POWER PLANTS IN NEVADA AND WESTERN UTAH

Source Name	Location (County, State)	Distance From TSPP (mi)	Distance From TSPP (km)	Maximum Distance to Significance Level (mi)	Maximum Distance to Significance Level (km)
Clark	Clark, NV	363	585	22	35
Harry Allen	Clark, NV	346	557	6	10
Sunrise	Clark, NV	360	580	9	15
Reid Gardner	Clark, NV	322	519	28	45
Valmy	Humboldt, NV	140	225	28	45
White Pine	White Pine, NV	100	161	0	0
Intermountain	Millard, UT	170	274	0	0
Thousand Springs	Elko, NV	0	0	28	45

Table 5.16-2. MAXIMUM DISTANCE TO MODELED ANNUAL NO_2 SIGNIFICANCE LEVEL (1 $\mu g/m^3$) FOR PROPOSED AND PERMITTED POWER PLANTS IN NEVADA AND WESTERN UTAH

Source Name	Location (County, State)	Distance From TSPP (mi)	Distance From TSPP (km)	Maximum Distance to Significance Level (mi)	Maximum Distance to Significance Level (km)
Clark	Clark, NV	363	585	37	60
Harry Allen	Clark, NV	346	557	16	25
Sunrise	Clark, NV	360	580	8	13
Reid Gardner	Clark, NV	322	519	40	65
Valmy	Humboldt, NV	140	225	6	10
White Pine	White Pine, NV	100	161	43	70
Intermountain	Millard, UT	170	274	11	18
Thousand Springs	Elko, NV	0	0	28	45

no significant cumulative impacts should result between the proposed TSPP and these proposed or permitted major sources. Similar modeling was performed to assess potential cumulative impacts on a 24-hour averaging basis. Attention was focused on TSPP and the two nearest plants (i.e., Valmy and White Pine Power Project). There is no 24-hr EPA-defined significance level for NO_2, so the assessment considered only SO_2. The proposed White Pine Power Project has low SO_2 emissions and very tall stacks, so there was no overlap of Zones of Influence. However, the Zones of Influence for SO_2 from Valmy and TSPP would be sizeable and were found to come close to overlapping as shown in Figure 5.16-4 and Table 5.16-3.

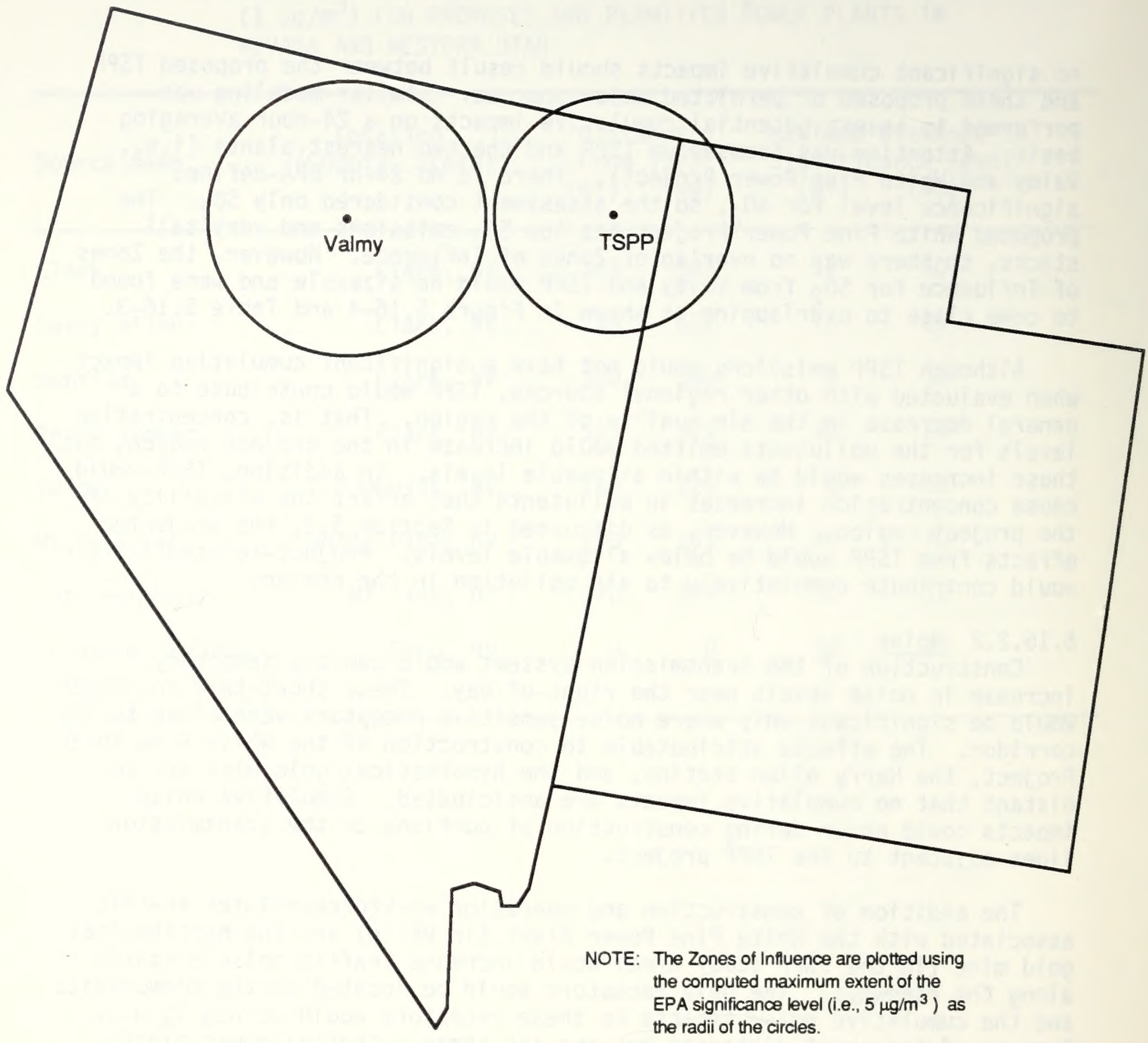
Although TSPP emissions would not have a significant cumulative impact when evaluated with other regional sources, TSPP would contribute to a general decrease in the air quality of the region. That is, concentration levels for the pollutants emitted would increase in the project region, but these increases would be within allowable levels. In addition, TSPP would cause concentration increases in pollutants that affect the visibility of the project region. However, as discussed in Section 5.1, the projected effects from TSPP would be below allowable levels. Project-related traffic would contribute cumulatively to air pollution in the region.

5.16.2.2 Noise

Construction of the transmission systems would cause a temporary increase in noise levels near the right-of-way. These short-term increases would be significant only where noise-sensitive receptors were close to the corridor. The effects attributable to construction of the White Pine Power Project, the Harry Allen station, and the hypothetical gold mine are so distant that no cumulative impacts are anticipated. Cumulative noise impacts could occur during construction of portions of the transmission lines adjacent to the TSPP project.

The addition of construction and operation workforce-related traffic associated with the White Pine Power Plant (in Wells) and the hypothetical gold mine (in the TSPP study area) would increase traffic noise slightly along the roadways. The only receptors would be located in the communities and the cumulative noise impacts to these receptors would be negligible. Because of the great distances between the three potential power plants, there would not be any cumulative noise impacts resulting from commute or construction traffic.

Noise from operation of the transmission lines would be negligible during fair weather, but may be audible near the right-of-way during wet weather conditions. The increases in intermittent audible noise levels would depend upon the size (i.e., the voltage) of the transmission line, its height, and the distance to sensitive noise receptors. Noise levels predicted for the 345-kV Valmy Power Plant transmission line at the edge of the right-of-way indicate that the system should be inaudible approximately 94 percent of the time, and when audible, would be primarily in the range of 46 to 52 dBA.



NOTE: The Zones of Influence are plotted using the computed maximum extent of the EPA significance level (i.e., 5 μg/m^3) as the radii of the circles.

FIGURE 5.16-4. ZONES OF INFLUENCE FOR SO_2 EFFECTS - 24-hr. AVERAGE CONDITIONS

Table 5.16-3. MAXIMUM DISTANCE TO MODELED 24-HOUR SO_2 SIGNIFICANCE (5 $\mu g/m^3$) LEVEL FOR VALMY POWER PLANT AND THE PROPOSED TSPP

Source Name	Location (County, State)	Distance From TSPP (mi)	Distance From TSPP (km)	Maximum Distance to Significance Level (mi)	Maximum Distance to Significance Level (km)
Valmy	Humboldt, NV	140	225	62	100
Thousand Springs	Elko, NV	0	0	59	95

5.16.2.3 Soils

Construction of the proposed TSPP would disturb and alter natural soil characteristics (including compaction) and, in some cases, result in the permanent loss of some soil material. As each of the proposed power plant projects, related transmission systems, and the hypothetical gold mine would be expected to have similar effects to soils, a cumulative impact to soil resources could occur.

5.16.2.4 Ecological Resources

The project could increase poaching and harassment of wildlife, and animal-vehicle collisions due to the increase in population and presence of workers. This impact would contribute to existing problems in this area. The addition of these types of impacts from the hypothetical gold mine project north of TSPP and from the additional population in Wells from the White Pine Power Project would add further to these cumulative effects.

5.16.2.5 Cultural Resources

Any effect to cultural resources would be a reduction of the nation's resource base. Therefore, direct affects resulting from construction and operation of the White Pine Power Plant, the Harry Allen Station, the hypothetical gold mine, and the transmission projects would result in cumulative impacts with the TSPP project.

Increased access to areas containing cultural resources can contribute to unauthorized artifact collection. The cumulative removal and destruction of cultural resource sites by unauthorized individuals can result in a significant impact to the diminishing base. Sources of additional impacts to cultural resources include inadvertent damage by off-road vehicle use, and increased chance of wildfire (with possible resultant destruction of perishable sites such as wickiups and antelope traps) because of increased recreational use of the land for other legitimate reasons (firewood cutting, development of material pits, home sites, etc.) due to population increases. In addition to the impacts described above, the construction of transmission lines would result in significant impacts from placement of the overhead transmission lines and towers within the nearby viewshed of a property that is listed or eligible for listing in the National Register of Historic Places. An example would be locating the corridor nearby and paralleling the historic Emigrant Trail. The intensity of this impact would depend on the magnitude of previous developments in the area where transmission lines cross the corridor. Impacts also could result from construction of transmission lines across lands that have traditional or religious values to Native Americans. In addition, the cultural resource data base accumulated as a result of these proposed projects increases our knowledge of the prehistory, ethnohistory, and history of the area.

5.16.2.6 Paleontology

Increased access to areas containing paleontological localities could encourage the collection of paleontological specimens which would diminish the existing resource base resulting in cumulative impacts. Destruction of

paleontological localities could occur as a result of off-road vehicle use in and adjacent to the project area by the construction and operation crews of the hypothetical gold mine and the portions of the transmission projects in proximity to the TSPP project site.

5.16.2.7 Visual Resources

The visual effects attributable to construction of the White Pine Power Project, the Harry Allen Station and the hypothetical gold mine are so distant that no cumulative impacts are anticipated.

Transmission lines could create strong vertical line and moderate texture contrasts with surrounding landscape, particularly where they parallel near the travel route of regional highways. These contrasts would draw attention to project features and dominate the foreground setting. Significant visual impacts could occur along segments of transmission lines where they cross ridgelines or lands with high visual qualities. The location of towers would likely introduce impacts to the skyline along ridgeline segments and draw strong visual attention from viewers traveling on highways or using regional recreational resources. Figure 5.16-5 is a photographic simulation of a possible transmission line as viewed from Highway 93 at the Wilkins turnoff onto the Thousand Springs Road. Transmission segments within the viewshed of the TSPP viewshed would result in cumulative impacts.

5.16.2.8 Recreational Resources

Impacts to recreational resources would be related to the visual impacts discussed above. Impacts would be more significant where transmission lines cross by or within a primary viewshed of a recreational area.

Cumulative impacts would also occur to developed recreation sites and hunting and fishing resources from the increase in population associated with the inmigration of construction and operation workers associated with the White Pine Power Plant (in Wells) and the hypothetical gold mine and portions of the transmission lines located in proximity to the TSPP site (in all communities in the TSPP study area).

5.16.2.9 Socioeconomics

The White Pine Power Project is located approximately 89 miles south of Wells along Highway 93. The closest community to this project is Ely in White Pine County at a distance of 45 miles. The City of Ely has a population of over 5000 people (in 1988). It would most likely attract a majority of the construction and operation workforce associated with the White Pine Power Project, due to its proximity to the project site and its size relative to the City of Wells. However, some workers could choose to reside in Wells and commute 89 miles each way to the project site. Using a similar gravity model to that used for the TSPP project, approximately 10 percent of the workers would reside in Wells and 90 percent in Ely. The White Pine Power Plant anticipated a peak construction workforce of 2345. This would result in 230 workers with their families in the City of

Wells. The White Pine workers residing in Wells would place further demands on support services there, resulting in severe cumulative impacts to housing and service provision in the City of Wells.

The Harry Allen Station is located approximately 350 miles south of the TSPP and would therefore have no cumulative worker-related socioeconomic impacts with the TSPP project.

The hypothetical gold mine project is assumed to be located approximately 18 to 30 miles north of the project site. The 100 construction workers and 75 operation workers would likely reside in Wells, Jackpot, and Twin Falls, Idaho. The addition of gold mine workers and TSPP project workers in these communities would increase the existing demand for services. Depending on the distribution of the two workforces, the socioeconomic impacts would be significant, especially to the City of Wells. These impacts in Wells would be further increased with development of the White Pine Power Plant.

The cumulative impacts associated with construction of the Southwest Intertie Project and the electric power transmission facilities that would carry power from the TSPP project would depend upon the timing of these projects. The construction crews of the transmission projects would utilize temporary housing in the TSPP study area when construction of the transmission lines was occurring in proximity to the TSPP project site. If this transmission construction occurred simultaneously with the peak construction of the TSPP project, impacts to temporary housing could occur in the communities in the TSPP study area.

All of these projects would contribute tax revenues to the state and this is seen as a cumulative effect.

5.16.2.10 Land Use

The land acquisition for the proposed TSPP project would change existing land status, resulting in an increased grazing capacity of 1553 AUMs. The proposed construction and operation would result in a net loss of 88 AUMs. Impacts to land use resulting from construction and operation of the transmission system would be minimal if the transmission lines are located within BLM-designated utility line corridors. If the hypothetical gold mine were located on public lands, AUMs would be lost, resulting in a cumulative impact.

5.16.2.11 Transportation

The traffic analysis discussed in Section 5.13 included forecasts of regional growth in traffic levels that would occur independent of the TSPP project. Although the proposed project and the hypothetical gold mine would add more traffic to existing and future conditions, the cumulative impacts would not affect the high level of service and would therefore not be significant.

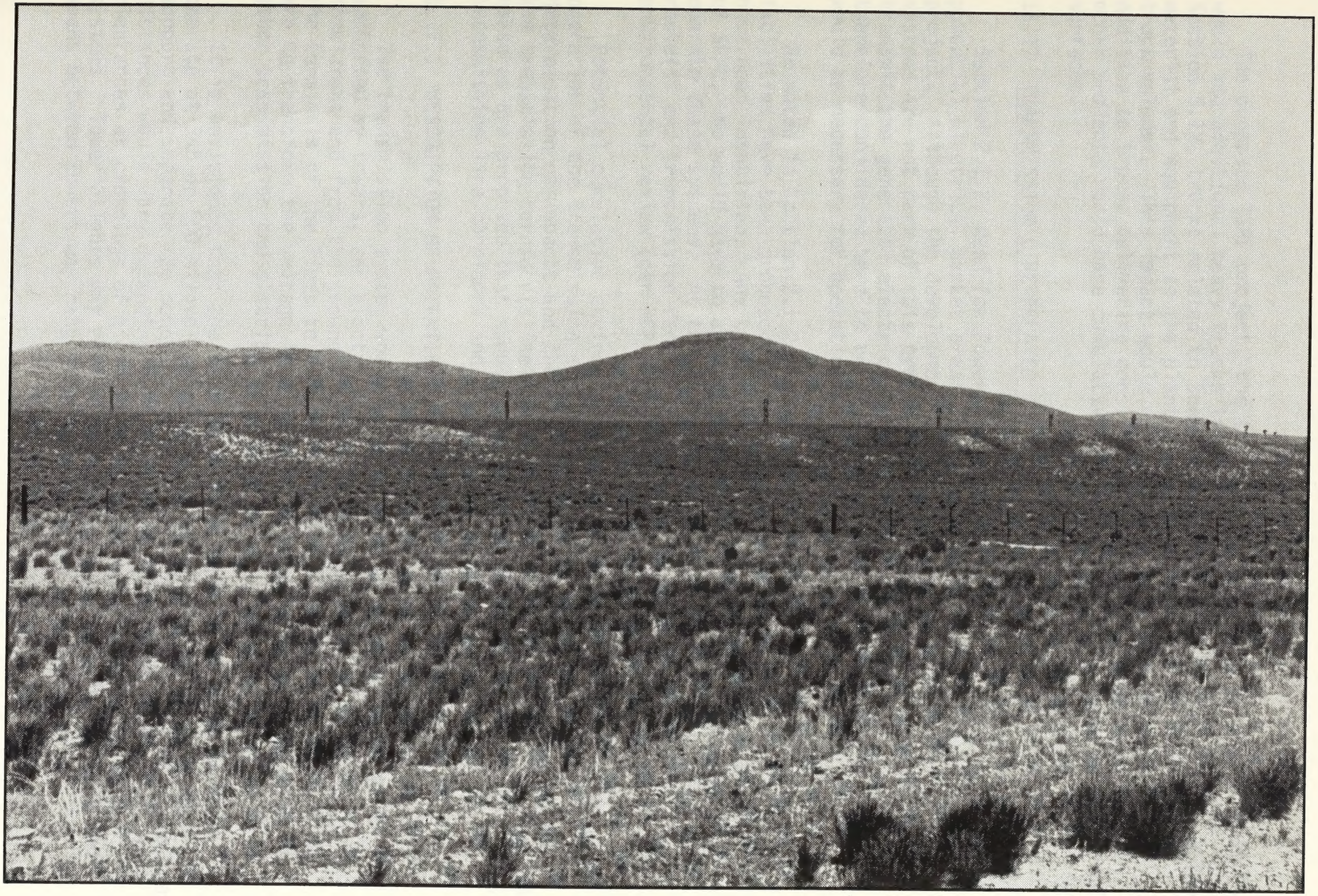


Figure 5.16-5. PHOTOGRAPHIC SIMULATION OF 345-kV TRANSMISSION LINE

The proposed TSPP project, the transmission projects and power projects would add additional heavy trucks to the regional roads. As discussed in Section 5.12, trucks related to the TSPP project would deliver construction material and equipment to the plant site, adding about 2 to 4 percent to truck volumes. This impact would not be significant by itself, but, in addition to trucks delivering construction material and equipment to the other projects would have cumulative contributions to wear and tear of road surfaces.

15.17 TRANSMISSION LINE-RELATED IMPACTS

Section 2.1.2, Need for Power Transmission Facilities, describes the potential electrical market areas that could be supplied by the proposed project. Although the development of off-site electrical transmission systems are not part of this proposed action, they would be needed to transmit the generated electricity from the plant to market areas, and are therefore considered here to be reasonably foreseeable facilities that would be necessary for operation of the project.

As noted in Section 2.1.2, no specific transmission line corridors or facilities have been proposed at this time, although general market areas have been identified. Any transmission lines would be the responsibility of SPPC, who would have to apply to the BLM for approval to construct and operate these systems. At the time of application, when a specific route(s) and transmission facility design(s) are known, a comprehensive environmental review (per NEPA requirements) would be conducted.

Potential cumulative environmental impacts from the construction and operation of the transmission system are described below. The final determination of impacts and their significance would be dependent upon the transmission corridor(s) selected and the system design(s). Mitigation measures are proposed that should be considered in the siting of the transmission line corridors and preliminary design of the facilities.

5.17.1 DESCRIPTION OF POTENTIAL TRANSMISSION SYSTEMS

The transmission system would consist of above-ground conductor wires supported by towers, and electrically isolated from the towers by insulators and from the ground by air. Substations may be constructed at the terminals of the lines to provide control of the transmission system and to transform the voltage level for retransmission or distribution to other transmission and distribution systems.

It is envisioned that the transmission system would be designed to operate at 345 or 500 kilovolts (kV). Steel or aluminum towers would support and separate the conductor wires. The tower heights and separation distances would vary depending on topography and the need to maintain safe clearances at crossings of highways, railroads, or other transmission systems. Tower heights may range from approximately 100 to 150 feet and spans between towers may range from approximately 500 to 2500 feet.

Depending on tower design, it is expected that tower foundations would be made of reinforced concrete, each designed for site-specific soil and geologic conditions.

ROW would be required for the transmission system. The width of ROW would depend on the clearances required for construction, operation, maintenance, and safety, and would be determined based on the design of the facilities. Generally, ROW requirements for high-voltage transmission systems of the type envisioned for the project range from 100 to 250 feet wide.

5.17.2 POTENTIAL ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES AIR QUALITY

No significant impacts to air quality would be expected from transmission system construction or operation. Installation of towers and foundations would cause temporary increases in fugitive dust. Construction and use of access roads would also raise dust.

Mitigation measures to minimize dust emissions would include limiting vegetation clearance, blading, and grading along the transmission corridor right-of-way. Vegetation cleared along access roads should be limited to that necessary for vehicles to obtain access. Vegetation should be permitted to re-establish wherever feasible.

There is a potential for ozone and NO_x to form within an electric field corona along a transmission line. A corona is the ionized field surrounding transmission lines where large enough voltage gradients occur. Studies reported in the North Valmy Power Station EIS indicate that these air pollutant levels are very low, and the highest rates of formation take place during wet or humid weather conditions, which occur infrequently in Nevada (Westinghouse Electric Corporation 1976).

5.17.2.1 Noise

Construction of the transmission system would cause a temporary increases in noise levels near the ROW. These short-term increases would be significant only where noise-sensitive receptors are close to the corridor.

Noise from operation of the transmission lines would be negligible during fair weather, but may be audible near the ROW during wet weather conditions. The increases in intermittent audible noise levels would depend upon the size (i.e., the voltage) of the transmission line, its height, and the distance to sensitive noise receptors. Noise levels predicted for the 345-kV Valmy Power Plant transmission line at the edge of the ROW indicate that the system should be inaudible approximately 94 percent of the time, and when audible, would be primarily in the range of 46 to 52 dBA.

To avoid noise impacts, the transmission corridors should be routed away from sensitive noise receptors, such as residences, schools, hospitals, and developed areas.

5.17.2.2 Geology

The transmission system could be subject to the same geologic hazards discussed in this EIS for the proposed power plant facilities. These include earthquake-induced hazards such as strong ground motion, fault rupture, liquefaction, and rock and debris slides. Other hazards could include flooding and potential subsidence.

The placement of any transmission system components, such as towers and substations, should be designed in accordance with geotechnical review of the sites. Tower and substations can be designed to prevent damage from seismic-related hazards through the use of deep foundations, anchoring and bracing of structures, and use of supplementary support systems such as guy wires. Floodplain characteristics and potential differential settlement should also be examined for placement and design of structures.

5.17.2.3 Soils

Construction of transmission lines would affect soils directly where transmission structures would be installed and where access roads would be constructed. Transmission line construction would involve partial clearing of vegetation, limited grading or blading of the access road, and limited excavation at the tower and substation sites (for footings). Potentially less severe impacts could also occur to other soils within the construction ROW.

Construction in areas containing soils with poor road-building or poor construction/excavation characteristics, high erosion potential, and/or steep slopes would likely result in increased soil erosion and soil loss unless mitigation measures were successful in limiting erosion and re-establishing vegetation, or unless the steepest part of the areas could be avoided.

To avoid these impacts, the transmission system should be designed to span small streams, floodplains, and other areas containing soils with cutbank-instability characteristics or high erosion potential. The measures recommended for fugitive dust control (see Air Quality above) would also minimize impacts to the soil resource.

5.17.2.4 Ecological Resources

Construction of the transmission system would result in the loss of vegetation and habitat where tower footings and substations are located. The significance of the impact would depend upon the quality and relative abundance of the habitat lost. Generally, considering the small areas required for facility foundations, these impacts should not be significant.

The transmission system could open previously inaccessible areas to human presence through the installation of roads for construction and

maintenance. Workers as well as trespassers using the access road could increase road kills, poaching, and general harassment of wildlife in the area of the transmission corridor.

The high-voltage transmission lines could also result in electrocution of raptors whose wingspans are wide enough to contact both a conductor and a grounding surface simultaneously. Transmission towers, conductors, and spacing of lines should be designed to preclude the electrocution of species with wide wingspans.

Collisions of birds with transmission lines is a potential direct impact. Transmission lines do not act as barriers to most birds, although birds typically increased their altitude to cross above the lines (WCC 1982b). Fast-flying birds at low-flight altitudes in tight flocks were most vulnerable to collisions. Transmission lines located perpendicular to low-altitude flyways near water had the highest occurrence of collisions. Small-diameter guy wires were the cause of all observed bird collisions with 230- and 500-kV transmission lines. Collisions are generally greatest in areas of decreased visibility due to fogging or adverse weather, and are more severe in areas adjacent to raptor concentration areas, waterfowl wintering staging areas, or other areas with avifauna concentrations. The overall bird mortality caused by bird collisions was not considered significant (WCC 1982b).

Increased predation of rodents and small game by raptors may occur in the vicinity of the towers, since they may be utilized as perches. Generally, this is not considered a significant impact.

5.17.2.5 Cultural Resources

Both direct and indirect impacts to cultural resources could occur as a result of building transmission system facilities. Cultural resources could be directly disturbed during construction, including blading or grading of access roads, or excavation of tower footings or substation foundations. Indirect, significant impacts could occur from placement of the overhead transmission lines and towers within the nearby viewshed of a property that is listed or eligible for listing in the National Register of Historic Places. An example would be locating the corridor nearby and paralleling the historic Emigrant Trail. The construction of power lines along or across this corridor could result in two types of effects. The first would be the effect to campsites or extant sections of wagon trails due to the placement of power poles or structures, and the establishment of any new roadways associated with the transmission lines. The second type of impact would be the effect the transmission lines introduction would have on the trail's integrity of setting, feeling, and association. The intensity of this impact would depend on the magnitude of previous developments in the area where transmission lines cross the corridor. Finally, impacts could also be associated with crossing lands that have traditional or religious values to Native Americans.

Direct impacts to cultural resources could be mitigated by following the Historic Properties Identification Plan and the Historic Properties Treatment Plan discussed in Section 5.9. Indirect visual impacts should be avoided through careful design and placement of facilities away from properties eligible or potentially eligible for listing on the National Register of Historic Places, or properties of traditional or religious value to Native Americans. To avoid or minimize these potentially significant impacts, early consultation with the SHPO and potentially affected Native American groups should be conducted during the early phases of corridor selection and preliminary design.

5.17.2.6 Paleontological Resources

Impacts to paleontological resources of any proposed transmission corridor cannot be determined without specific investigation.

5.17.2.7 Visual Resources

Transmission lines could create strong vertical line and moderate texture contrasts with surrounding landscape, particularly where they parallel near the travel route of regional highways. These contrasts would draw attention to project features and dominate the foreground setting during the driving duration period. Significant visual impacts may occur along segments of transmission lines where they cross ridgelines or lands with high visual qualities. The location of towers would likely introduce impacts to the skyline along ridgeline segments and draw strong visual attention from viewers traveling on highways or using regional recreational resources. Figure 5.16-5 is a photographic simulation of a possible transmission line as viewed from Highway 93 at the Wilkins turnoff onto the Thousand Springs Road.

Mitigation measures for visual impacts would be similar to those identified for the proposed action, particularly with regard to color. The following mitigation measures would further reduce the visual contrast of a proposed transmission system:

- Structures should be strategically placed to make maximum use of existing topography and available vegetation for screening.

- Transmission lines should be at the base of slopes when feasible to provide a background of topography and/or natural cover.

- Materials used to construct transmission line structures should harmonize with the natural surroundings. Self-protecting, bare steel should be considered at angles, eliminating guy wires. Where natural wood poles are appropriate, the color range should be limited to present a unified series of poles.

- Choice of conductor material should be carefully considered to avoid sheen or a strong silhouette and to provide blending of the conductors into any given setting through which the line must pass.

5.17.2.8 Recreational Resources

Impacts to recreational resources would be related to the visual impacts discussed above. Impacts would be more significant where transmission lines cross by or within a primary viewshed of a recreational area. Corridor selection and facility design should consider avoiding recreational areas and their viewsheds, where feasible, and should consider incorporating of the mitigation measures listed for visual resources.

5.17.2.9 Socioeconomics

Impacts to socioeconomics would probably be insignificant for construction and operation of transmission system facilities. Construction would be transitory along the routes, and would have only temporary effects (if any) on employment and income in nearby communities.

5.17.2.10 Land Use

Impacts to land use should be minimal if the transmission lines are located within BLM-designated utility line corridors. Potential corridors that could be used to connect the proposed power TSPP project with regional market areas are shown on Figure 2.2-1. The placement of towers would remove a small amount of land from its current use. To minimize land use impacts, current use of the land (such as grazing) should be permitted to continue, as long as it is compatible with the transmission line.

5.17.2.11 Transportation

Transmission line impacts to surface transportation would be minimal. Construction of any towers or other facilities more than 200 feet in height would require a no-hazard declaration from the Federal Aviation Administration. Placement of towers on ridgelines should be considered potential aviation hazards.

Location of towers and transmission lines through or adjacent to agricultural lands could be a significant impact to crop dusting of fields. Transmission and distribution lines are considered a major hazard by crop dusters and when located in or near intensively managed agriculture fields can limit or alter the flight pattern of the crop duster, and could eliminate the use of crop dusting in that area. In general, this is not a significant impact in Nevada since the use of crop dusting is minimal, or not used at all, especially in the project region. However, to avoid this impact, transmission corridors should be routed away from any prime agricultural lands where crop dusting is utilized.

5.17.2.12 Electric and Electromagnetic Field Effects

Electrical effects that can be associated with transmission systems include radio/television interference and potential physiological effects. The possibility of radio and television interference has been studied for a variety of 230- and 345-kV transmission line designs (Westinghouse Electric Corporation 1976). The effect of air density and various weather conditions were considered (radio and television interference is greatest during rain or snowfall). In average fair weather

conditions, it was predicted that all stations could be received with very good reception 70 to 130 feet from the edge of the ROW and that all stations could be received at the edge of the ROW with some interference. Routing of the transmission line away from residences and developed areas would avoid this impact.

Potential physiological health effects associated with electromagnetic fields has received increasing attention in recent years based on the findings of studies that indicate a potential association. The studies indicate that electromagnetic fields from a wide variety of sources, including low-level electromagnetic fields associated with common electric circuits, may be of concern. Although this subject is controversial, it would be prudent to locate the transmission system away from residential areas to avoid any potential adverse effects. Research into health guidelines or standards for recommended separation distances between the transmission system and sensitive land uses should be conducted during the selection of a transmission corridor.

5.18 UNAVOIDABLE ADVERSE IMPACTS

Unavoidable impacts are those adverse effects which cannot be avoided should the project be implemented. The following summarizes both significant and nonsignificant unavoidable impacts. Proposed mitigation for these impacts is included in Sections 5.1 through 5.13, and is not repeated here.

There would be a temporary deterioration of ambient air quality during construction even if dust control measures are implemented. Power plant emissions would be within Federal and state ambient air quality standards.

Construction of TSPP facilities would remove soil and vegetation from the site and corridors, thereby reducing wildlife and livestock forage and habitat. Weedy species could invade disturbed areas. Soil excavation and earth moving during construction and modification of existing drainages could increase the potential for erosion on the site or along the transmission corridors. A small area of wetlands near Winecup Ranch would be disturbed. Due to increases in population and workers associated with the project, increases in poaching, animal-vehicle collisions, and disturbance to wildlife could occur. A low (minor) number of birds could be killed from inadvertent impact with the power plant stacks. The Thousand Springs Creek bed would be disturbed from installation of a box-culvert where the creek is crossed by the proposed access road.

Groundwater withdrawal and human encroachment could result in impacts to nearby springs and ponds located near the proposed project wellfields. There also could be reductions in streamflow along Thousand Springs Creek in the reach between Crittenden Creek and Dake Reservoir. During extended dry periods and under extreme conditions, Dake Reservoir could be lowered below historic levels or emptied completely, significantly affecting the fishery. Groundwater withdrawal could reduce soil moisture in wetland

areas, thereby causing a successional change to less productive vegetation. Up to about 32,000 ac-ft/yr of water that would be appropriated to TSPP after full-scale development of the project would be unavailable for other uses during the life of the project.

Natural springs could be affected by groundwater withdrawal. Some degradation of groundwater quality would occur because of increased total dissolved solids. Dake Reservoir levels could decrease after long-term pumping.

Even after a detailed cultural resource field inventory is conducted prior to construction, inadvertent damage to undiscovered archaeological sites could still occur. Additionally, sites that are considered significant and subsequently treated with data recovery procedures are nonetheless lost from the archaeological data base. Data remaining in the site following the recovery treatment are also lost, along with whatever data are destroyed in the course of mitigation.

The introduction of the TSPP and associated linear facilities would affect the scenic values of the natural landscape by creating a visual intrusion.

Noise levels would increase in the vicinity of construction sites on a short-term basis. Nonsignificant increases in traffic would occur on regional roads.

The City of Wells would experience an 11 percent increase in population after full buildout of the proposed action. Impacts to personal and social wellbeing in Wells are likely consequences of shortages in housing and other facilities. These can be offset in the long term by beneficial impacts to personal and social wellbeing due to net increase in employment among residents.

Increased human activity could impact recreational areas. Impacts on agriculture would result from the removal of grazing land and the gradual phasing out of approximately 15,000 ac-ft/yr of water for irrigation use.

Impacts of the No Construction-Worker Camp Alternative for both Elko and Wells would be like those of the proposed action for Wells, that is, some shortages of community resources and associated negative impacts to personal and social wellbeing during the construction phase. Negative impacts would be greater with this alternative because of greater incidence of crime and lesser sense of security expected with an increase of workers without families in the cities. These could be offset in the long term in Wells by beneficial impacts to personal and social wellbeing due to net increase in employment among residents. There would be no long-term impacts to community resources or social wellbeing in Elko.

5.19 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The primary resources being used in this project involve the withdrawal of water from groundwater supplies in the region and a portion of the available air increment. Water levels would decline in some wells, and replenishment of the aquifer may require up to 100 years. Use of the air increment could require that another PSD source purchase offsets for SO_2 and/or NO_2 from TSPP in order to be constructed and operated. The proposed TSPP would use approximately 99 percent of the NO_2 air increment and 50 percent of the SO_2 increment over the projected life of the project (i.e., 49 years). Other uses include the removal of vegetation, the disturbance and exposure of soils, potential disturbance of cultural resources, and installation of facilities affecting the areas of visual resources.

In exchange for these environmental uses, electrical energy would be available to consumers in the western U.S. Generation of electricity from coal would help conserve other fossil fuels. In addition to energy, employment and economic benefits would accrue to Elko County during the construction and operation periods. There would also be economic benefits to other entities in the State of Nevada.

5.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Approximately 224 million tons of coal would be consumed over the life of the project. Water evaporated as a part of TSPP cooling and not returned to the Thousand Springs hydrologic basin would be considered as consumed. Approximately 540 acres of land would be required for the long-term disposal of fly ash, scrubber wastes, bottom ash, and other waste products.

Existing soil integrity at the location of the TSPP facilities would be disturbed during construction, ultimately resulting in irretrievable soil losses. In addition, it would take time for soil composition, including horizon characteristics, to return to their original state after TSPP facilities were removed.

Existing vegetation would be removed at the location of the TSPP facilities during the initial stages of construction. Complete restoration of the vegetation and structural composition of the plant community is not expected. Therefore, the loss of existing vegetation diversity at the TSPP site would be irretrievable. In addition, it would take decades to re-establish the original ecosystem after groundwater withdrawals are discontinued. Groundwater withdrawals may have irretrievable impacts on wildlife dependent on these water supplies. For example, by the time groundwater supplies are at preproject levels, low wildlife populations, such as antelope, may be extirpated from the area.

Migrating mule deer population would be reduced due to vehicle collision and difficulties in negotiating additional fencing.

Potential ground subsidence and settlement could occur due to groundwater withdrawals. The subsidence is expected to be minor, but irreversible.

Other irreversible changes could result from the visual impact of construction scars or any facilities that would not be removed at the end of the operation period. Increased population due to TSPP could impact future use of recreational resources. There could be inadvertent destruction of cultural resources during construction.

5.21 ENERGY CONSUMPTION

The proposed action would provide electrical energy generation of approximately 250 MW per unit. Coal would be consumed at a maximum of approximately 121 tons/hr per generating unit. There is always a loss of energy during generation and distribution, due to inherent inefficiencies of the generation unit and distribution system, and to energy demand to run the power plant, supply the fuel, and transmit the electricity. Generally, approximately 30 to 40 percent of the net energy contained in a fuel source is eventually supplied to a consumer, due to energy losses from steam-electrical generation and transmission (Talaga et al. 1984).

Construction and operation of the proposed action would require consumption of nonrenewable energy resources, including petroleum fuels for construction activities and manufacture of plant components, and consumption of coal for operation of the plant. All of the alternatives considered would have approximately the same energy requirements as the proposed action.

6.0
CONSULTATION AND COORDINATION

This section provides a list of individuals in state, Federal, and local government agencies and private interest groups who were consulted during the preparation of the Draft EIS. Responses were solicited from relevant agencies regarding particular environmental issues of concern addressed in the Draft EIS. Communication regarding these issues varied from telephone contact to informal interviews to formal meetings.

Advisory Council on Historic Preservation, Golden, Colorado
Alan Stanfill

Air Resource Specialists
David Deitreich, President

Bridger-Teton National Forest, Jackson, Wyoming
Alan F. Galbraith, Hydrologist

Brigham Young University, Department of Botany
Dr. Lawrence St. Clair

Building and Construction Trades Council of Northern Nevada
Dan Rusnak, Secretary-Treasurer & Business Representative

City of Carlin
Earl Trousdale, Mayor

City of Elko
O.P. Cash, Fire Chief
Gordon Forbes, Police Chief
Michael Klein, Assistant City Manager
Pat Knight, Resident (also Administrator, Elko Band of Te-Moak Tribes)
Ferron Konakis, City Engineer
Jay Kump, Resident
Lorry Lipparelli, City Manager
Kelly Lucy, Resident (also Northwest Nevada Development Authority)
Charles Williams, Public Works Director

City of Twin Falls
Dave McAlindin, Director, City Department of Economic Development
Lon McDonald, Area Labor Market Analyst, Department of Employment
Betty Zuck, Chamber of Commerce

City of Wells
Ella Lee Corone, Chamber of Commerce Treasurer
Hal Dunn, Former Acting City Manager/Police Chief
Mike Nannini, Resident (also former Mayor)
Sandy Neff, Zoning and Planning Chairman
Fritz Schacht, Public Works
Tony Schwab, Vice Mayor
Letitia Tripp, Economic Development Coordinator
George Yan, Mayor

Colorado State University, Natural Resource Ecology Lab
Carol Simmons

Community of Jackpot
Jay Snyder, Justice of the Peace

Community of Wendover
Donna Crick, Highland Realty
Margaret Wheeler, Recorder, Wendover (Utah)

Desert Research Institute, University of Nevada
Michael Campana
Roger Jacobson
Martin Mifflin (now with Mifflin & Associates)
Scott Tyler

Electric Power Research Institute, Palo Alto, California
Dr. Ralph Perhac

Elko Chamber of Commerce
Bobbi West, Tourist Information Specialist

Elko County
George Boucher, County Manager
Bill Guisti, County Assessor
Neil Harris, Undersheriff--Sheriff's Department
Cesare Salicchi, County Treasurer
Connie Walker, Sheriff's Department

Elko County Ambulance
Bill Webb

Elko County Library System
Hallie Gunn, Director
Earlene Larsen, Wells Branch
Carol Madsen, Elko Branch

Elko County School District
Paul Billings, Superintendent (Jan. 1, 1989 to present)
Dick Harris
Charles Knight, Superintendent (retired Dec. 31, 1988)

Elko General Hospital
Ruth Hawkins, Risk Management Administrator

Idaho Department of Health and Welfare, Boise, Idaho
John D. Ledger, Chief, Air Quality Bureau

National Climatic Data Center, Asheville, North Carolina
Sam McCowen

National Oceanic and Atmospheric Administration
Michael Erikson, Precipitation Monitor, Wells, NV
Verla Lee, Precipitation Monitor, Montello, NV

Native Americans
Roy Baker, Chair, Confederated Tribes of the Goshute Reservation
Susan Ball,[a] Environmental Coordinator, Shoshone-Bannock Tribes, Fort Hall, Idaho
Gracie Begay,[a] Former Chair, Wells Band, Te-Moak Tribes, Inter-Tribal Council of Nevada
Roland Brady, Western Shoshone Elders Council, Duck Valley
Alice Dick, Elder, Ruby Valley
Bill Dick, Elder, Ruby Valley
Benson Gibson, Elder, Owyhee
Corbin Harney,[a] Western Shoshone Elders Council, Battle Mountain
Robert Healy, Elder, Ruby Valley
Glenn Holley, Sr.,[a] Western Shoshone Elders Council, Battle Mountain
Pat Knight,[a] Administrator, Elko Band, Te-Moak Tribes South Fork Band, Te-Moak Tribes
Lew Maine, Elder, Battle Mountain
Dale Malotte,[a] Te-Moak Tribes of Western Shoshone Indians
Sally Marques,[a] Chair, Ely Indian Colony
Whitney McKinney,[a] Chair, Shoshone-Paiute Tribes of the Duck Valley Reservation
Gonnie Mendez,[a] Coordinator, Battle Mountain Band, Te-Moak Tribes
Jerry Millett,[a] Director, Shoshone National Council
Larry Piffero,[a] Assistant to Western Shoshone Elders Council
Joe Prior, Elder, Owyhee
Bennie Reilley,[a] Western Shoshone Elders Council, Ely
Frank Temoke,[a] Western Shoshone Elders Council, Ruby Valley
Tony Villalobos, Administrator,[a] Wells Band, Te-Moak Tribes
Raymond Yowell, Elder, Lee

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[a] Responses received by telephone, letter, or at a meeting.

Nevada Department of Conservation and Natural Resources

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Division of Water Resources
Ralph Gamboa, Elko

Nevada Department of Transportation
Donald Pray, Transportation Analyst

North East Nevada Development Authority
Kelly Lucy, Executive Director

Nevada Highway Patrol
Tony Kendall

Nevada State Historical Society
Philip Earl

Nevada State Museum
Margaret Brown

Oregon-California Trails Association
Thomas H. Hunt
Donald Buck

Southern Pacific Railroad
Hank Jay, Chief Train Dispatcher

State of Nevada
Wally Earhart, Dept. of Taxation--Centrally Assessed Properties
Jim Najima, Division of State Parks, Planning Specialist
John Richardson, Division of State Parks, Administrator
Linda Smith, Department of Education
Gene Weller, Department of Wildlife, Specialist

Stearns-Roger Engineering Corp.
Peter Russell, Project Engineer

University of Nevada, Reno
John Dobra, Professor of Economics

U.S. Department of Agriculture

Forest Service, Rocky Mountain Forest Experimental Station
Richard Fischer

Forest Service, Rocky Mountain Forest, Fort Collins, Colorado
Douglas G. Fox, Ph.D., Chief Meteorologist

Soil Conservation Service, Boise, Idaho
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Soil Conservation Service, Elko, Nevada
James Evans

U.S. Department of the Interior

Bureau of Land Management (BLM), Idaho State Office, Boise
Steve German

Geological Survey
Eugene Rush (Retired), Denver
Charles H. Thorman, Denver
Richard Young, Elko

National Park Service - Air, CIRA Foothills Campus, Colorado State University
William Malm

U.S. Environmental Protection Agency, National Dry Deposition Network
Rudy Boksleitner, Project Officer

U.S. Environmental Protection Agency, Research Triangle Park
James Dicke

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F. Burnell Cordner, Air Quality Officer

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Catherine Kraeger-Rovey, Consultant to BLM

Wells Medical Center
Dr. Joseph Smith

Wells Rural Electric
Laurie Egbert

7.0
PUBLIC INVOLVEMENT

Public participation is an integral part of the environmental impact evaluation process. The goals of the public involvement effort are to ensure timely dissemination of public information, to obtain the views of interested persons, and to provide for public participation in the BLM decision making process. Agencies, groups, and individuals that were contacted and/or provided information for this EIS are identified in Section 6.0. Additional agencies that participated in the review of this draft document are listed under Section 7.3.

7.1 SCOPING PROCESS

The scoping activities described in Section 1.1.1 comprised the first step in the public participation process. A preliminary scoping document was developed, letters and news releases were mailed, a Federal Register notice was published, and meetings were held. Memoranda documenting Congressional delegation and State Clearinghouse briefings and all scoping meetings were compiled as a Final Scoping Document and are on file at the BLM, Elko District Office, Elko.

7.2 CONTACTS WITH KEY INDIVIDUALS OR GROUPS, AGENCIES

Key individuals or groups who are thought to be knowledgeable of the issues and the attitudes and expectations of the public were contacted by phone, letter, and/or personal meeting as team members proceeded through various stages of the EIS (Section 6.0).

7.3 FORMAL REVIEWS AND HEARING(S)

This Draft EIS is being sent to government agencies and several designated groups and individuals for formal review and comment. Public hearings, announced in the Federal Register and by news release, will be held. All comments received will be carefully considered as revisions are made for the Final EIS.

The BLM has designated cooperating agencies having jurisdiction by law or special expertise to review this document. The following agencies have been designated as cooperating agencies by the BLM for this DEIS:

Cooperating Federal Agencies

U.S. Forest Service, Region 4 Office, Ogden, UT
Jarbidge Ranger District, Buhl, ID
U.S. Park Service, Regional Office, Denver, CO
Great Basin National Park, Baker, NV
U.S. Environmental Protection Agency, Region IX, San Francisco, CA
U.S. Geological Survey, Carson City, NV
USDI Office of Environmental Affairs, Washington, DC
Dept. of the Army, Corps of Engineers, Sacramento, CA

Cooperating State Agencies

State of Nevada, Division of Water Resources, Carson City, NV
State of Nevada, Division of Environmental Protection, Air Quality, Carson City, NV

7.4 INVOLVEMENT TECHNIQUES

Public involvement techniques employed include news releases to the mass media; publication of notices in the Federal Register; letters to governmental agencies, organizations, and individuals; individual or small group meetings; formal hearings; briefings; and distribution of the EIS with technical appendices to public libraries and BLM offices.

8.0 LIST OF AGENCIES, INDIVIDUALS, AND GROUPS TO WHICH THIS DOCUMENT HAS BEEN DISTRIBUTED

A listing has been developed of those individuals, groups, organizations, and political representatives to whom all public documents will be sent. This includes, but is not limited to, the following:

I. GOVERNMENT AGENCIES, REPRESENTATIVES, STATE AND LOCAL GOVERNMENTS

A. Federal Agencies

Advisory Council on Historic Preservation
Department of Agriculture
    Forest Service
    Soil Conservation Service
Department of Defense
    Army Corps of Engineers
    Asst. Secretary of the Air Force
    Bolling Air Force Base
    Hill Air Force Base
    Langeley Air Force Base
    Mountain Home Air Force Base
Department of Energy
    Bonneville Power Administration
    Office of Environmental Compliance
Department of Housing and Urban Development
Department of the Interior
    Office of Environmental Affairs
    Bureau of Land Management
    National Park Service
    Bureau of Indian Affairs
    Bureau of Mines
    Fish and Wildlife Service
    Bureau of Reclamation
    Geological Survey
Department of Labor
    Office of Safety and Health Administration
Department of Transportation
Environmental Protection Agency - Regions 8, 9, & 10
Federal Aviation Administration
Federal Energy Regulatory Commission
Federal Highway Administration

B. Nevada Congressional Delegation

Senator Richard Bryan
Senator Harry Reid
Representative Jim Bilbray
Representative Barbara Vucanovich

C. State of Nevada

Governor
State Assemblyman
State Senator
Department of Administration
    State Clearinghouse
Division of Water Resources
Department of Wildlife
Land Use Planning Advisory Council
Multiple Use Advisory Board
Department of Energy
Attorney General's Office of Advocate for
    Customers of Public Utilities
Commission on Preservation of Wild Horses

D. Other State Governments

Idaho State Division of Environmental Quality
Idaho State Water Quality Bureau
Idaho State Air Quality Bureau
Utah State Division of Environmental Health
Utah State Bureau of Air Quality
Utah State Water Pollution Control
Utah State Clearinghouse

E. Local Governments

Wells City Mayor
Wells City Manager
Wells City Council
Wells Chamber of Commerce
Elko City Mayor
Elko City Manager
Elko Chamber of Commerce
Elko City Planning Commission
Elko County Manager
Elko County Commissioners
Elko County Planning Commission
Elko County Coordinated Resource Management & Planning
Elko County Association of Conservation Districts
Elko County Farm Bureau
Elko District Advisory Council
Nevada Association of Counties, Carson City, NV
Nevada League of Cities, Carson City, NV

Northeast Nevada Development Authority, Elko, NV
Jackpot Advisory Council, Jackpot, NV
West Wendover Advisory Board, Wendover, NV
Montello Advisory Board, Montello, NV
Tooele County Commissioners, Tooele, UT
Box Elder County Commissioners, Brigham City, UT
Twin Falls County Commissioners, Twin Falls, ID
Twin Falls City Council, Twin Falls, ID

II. REQUISITE LISTINGS

A. Libraries

USDI Natural Resource Library, Washington, D.C.
BLM Library, Denver Service Center, Denver, CO
University of Nevada Libraries, Reno & Las Vegas
Nevada State Library, Carson City, NV
Elko County Library, Elko, NV
Elko County Library Bookmobile, Elko, NV
White Pine County Library, Ely, NV

B. Media

Associated Press/UPI, Reno, NV
Buhl Herald, Buhl, ID
Deseret News, Salt Lake City, UT
Elko Daily Free Press, Elko, NV
Elko Independent, Elko, NV
Ely Daily-Times, Ely, NV
Energy Daily, Washington, D.C.
High Country News, Paonia, CO
High Desert Advocate, Wendover, NV
The Idaho Statesman, Boise, ID
KELK Broadcasting Company, Elko, NV
KRJC Radio Station, Elko, NV
Las Vegas Review Journal, Las Vegas, NV
Nevada Business Outlook, Carson City, NV
Reno Gazette Journal, Reno, NV
Salt Lake Tribune, Salt Lake City, UT
Times News, Twin Falls, ID
Wells Progress, Wells, NV
The Wendover Relay, Wendover, NV

C. Indian Interests

Battle Mountain Band, TeMoak Bands of Western Shoshone, Battle Mountain, NV
Confederated Tribes of the Goshute Reservation, Ibapah, UT
Duckwater Tribal Council, Duckwater, NV
Eastern Nevada Agency, BIA, Elko, NV
Elko Band Council, TeMoak Bands of Western Shoshone, Elko, NV
Ely Indian Colony, Ely, NV

Fort Hall Indian Reservation, Shoshone-Bannock Tribes, Fort Hall, ID
Intertribal Council of Nevada, Reno, NV
National Resources Impact Statement Coordinator, BIA, Washington, D.C.
Phoenix Area Office, BIA, Phoenix, AZ
Shoshone Business Council, Owyhee, NV
Shoshone-Paiute Tribes of the Duck Valley Reservation, Owyhee, NV
South Fork Band, TeMoak Bands of Western Shoshone, Lee, NV
TeMoak Bands of Western Shoshone Indians, Elko, NV
Wells Band Council, TeMoak Bands of Western Shoshone, Elko, NV
Western Shoshone National Council, Duckwater, NV
Western Shoshone National Council, Wells, NV

Also included on this list are those who have expressed specific interest in the Proposal and those who have demonstrated a desire to be informed of changes in management on public lands in this area.

9.0
LIST OF PREPARERS

The Administrative Draft EIS for the Thousand Springs Power Plant Project was prepared by Woodward-Clyde Consultants, Environmental Consultant, under a memorandum of understanding between the Bureau of Land Management, Thousand Springs Generating Company, and Woodward-Clyde Consultants. Woodward-Clyde Consultants was responsible for conducting environmental studies under Bureau of Land Management direction. The following individuals had direct responsibility for the preparation and development of the technical reports and the Administrative Draft EIS.

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Richard Bell - Soils; B.S., Biology, Geology, and Chemistry, University of Colorado; M.S., Agronomy, Colorado State University.

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10.0
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11.0 LIST OF ACRONYMS USED IN THE EIS AND ASSOCIATED TECHNICAL REPORTS

AC	Alternating current
ACGIH	American Conference of Governmental Industrial Hygienists
ACHP	Advisory Council on Historic Preservation
ACOE	Army Corps of Engineers
ACQAA	Acceptable concentration for the quality of ambient air
ac-ft	acre-feet
ac-ft/yr	acre-feet/year
AIRFA	American Indian Religious Freedom Act
APE	Area of Potential Effects
API	American Petroleum Institute
AQC	Air Quality Control
AQCR	Air Quality Control Region
ARQV	Air Quality Related Value
As	Arsenic
AUM	Animal unit month
BACT	Best available control technology
B(a)P	Benzo(a)pyrene
Be	Beryllium
b_{ext}	light extinction coefficient

BLM	Bureau of Land Management
BMS	Burner management system
BOOS	Burners out of service
BPA	Bonneville Power Administration
B-scat	Aerosol scattering coefficient
Btu	British thermal unit
CAA	Clean Air Act
Ca	Calcium
Caltrans	California Department of Transportation
CaO	Calcium oxide (quick lime)
$Ca(OH)_2$	Calcium hydroxide
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CCS	Combustion control system
CDBG	Community development block grant
CDOT	California Department of Transportation
CEC	California Energy Commission
CEMS	Continuous Emission Monitoring System
CEQ	Council on Environmental Quality
CFC	chlorofluorocarbon
cfs	Cubic feet per second
Cl	chlorine
cm	centimeter
CO	Carbon monoxide
CO_2	Carbon dioxide

CPUC	California Public Utilities Commission
CRT	Cathode ray tube
CSR	Candidate site region
Cu	Copper
cu yd	Cubic yard
dB	Decibel
dBA	A-weighted decibel level
DC	direct current
DCS	Distributed control system
DOC	Determination of Compliance
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
EDA	Economic Development Association
EEI	Edison Electric Institute
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
eq/L	Equivalent per liter
eq/m^2	Equivalent per meter squared
ESP	Electrostatic Precipitator
ET	Evapotranspiration
F	Fluoride
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission

FHWA	Federal Highway Administration
FLM	Federal Land Manager
FLPMA	Federal Land Policy and Management Act of 1976
GCM	Global climate models
g/g	Gram of water per gram of air
GIS	Geographic Information System
$g/m^2/yr$	Gram per meter squared per year
GO	Groundwater outflow
gpd,gpm	Gallons per day, minute
gpd/ft	gallons per day per foot
GR	Groundwater recharge
GWh/yr	Gigawatt hours per year
H, H^+	Hydrogen, hydrogen ion
H_2SO_4	Sulfuric acid
H_2CO_3	Carbonic acid
HC	Hydrocarbon
HNO_3	Nitric acid
HDPE	High density polyethylene
Hg	Mercury
HHV	Higher Heating Value
HPIP	Historic Properties Identification Plan
HPTP	Historic Properties Treatment Plan
hr	Hour
HUD	U.S. Department of Housing and Urban Development
Hz	Hertz (cycles per second)

IP	Induced Polarization
IMPROVE	Interagency Monitoring of Protected Visual Environments
in.	Inch
ISC	Industrial Source Complex
ISCST	Industrial Source Complex Short-Term
JWA	Jarbidge Wilderness Area
K, K_2O	Potassium, Potassium Oxide
kg/ha/yr	Kilograms per hectare per year
km	Kilometer
kV	Kilovolt
kva	Kilovolt-amp
kW	Kilowatt
kWh	Kilowatt hour
L_{10}	Sound level that is exceeded 10 percent of the time
L_{90}	Sound level that is exceeded 90 percent of the time
LAC	Level of acceptable change
lb/hr	Pound per hour
LCSA	Library Services and Construction Act
L_{dn}	Day-night sound level
LEA	Low excess air
L_{eq}	Equivalent sound level
LFM	Limited Area Fine Mesh Model
LOS	Lands of Sierra, Inc.
LP	Low pressure
L_x	Statistical sound level

M	Magnitude
m/sec	Meter per second
m^2/g	Meter squared per gram
MCR	Maximum continuous rating
MDCT	Mechanical Draft Cooling Tower
Mg	Magnesium
mg/m^3	Milligram per cubic meter
mg/L	Milligrams per liter
mgpd	Million gallons per day
mm	Millimeter
Mm^{-1}	One in 10 million
MMBtu	million British thermal units
mph	Miles per hour
MSL	Mean sea level
MW	Megawatt
MWh	Megawatt hour
Na, Na_2O	Sodium, Sodium Oxide
NAAQS	National Ambient Air Quality Standards
NAC	Nevada Administrative Code
NADP	National Acid Deposition Program
NAPAP	National Acid Precipitation Assessment Program
NAQR	Nevada Air Quality Regulations
NCAQ	National Commission on Air Quality
NCDC	National Climatic Data Center
NCPA	Northern California Power Agency

NDEP	Nevada Department of Environmental Protection
NDOT	Nevada Department of Transportation
NDOW	Nevada Department of Wildlife
NEA	National Energy Act
NENDA	North East Nevada Development Authority
NEPA	National Environmental Policy Act
NESHAP	National Emission Standard for Hazardous Air Pollutants
ng/m^3	nanograms per cubic meter
NH_4	Ammonium
$(NH_4)_2SO_4$	Ammonium Sulfate
NH_4NO_3	Ammonium Nitrate
NHPA	National Historic Preservation Act
NNPS	Nevada Native Plant Society
NNRR	Nevada Northern Railroad
NOAA	National Oceanographic and Atmospheric Administration
NO_2	Nitrogen dioxide
NO_3,NO_4	Nitrate, Nitrates
NO_x	Nitrogen oxides
NPC	Nevada Power Company
NRC	Nuclear Regulatory Commission
NPDES	National Pollutant Discharge Elimination System
NPPC	Northwest Power Planning Council
NPS	National Park Service
NRS	Nevada Revised Statutes
NSPR	New Source Performance Review
NSPS	New Source Performance Standards

NTN	National Trends Network
O_3	Ozone
$\sigma\theta$	Horizontal wind direction
ORV	Off-road vehicle
OSHA	U.S. Occupational Safety and Health Administration
OTA	Office of Technology Assessment
P	Precipitation
PAHs	Polycyclic aromatic hydrocarbons
Pb	Lead
pH	Acidity
PLUVUE	EPA Plume Visibility Model
$PM_{2.5}$, $_{10}$, or $_{15}$	Particulate matter smaller than 2.5, 10, 15 μm in diameter
POM	Polycyclic organic matter
ppb,ppm	Parts per billion, million
ppmv	parts per million by volume
PROM	Programmable Read Only Memory
PSC	Public Service Commission
PSD	Prevention of Significant Deterioration
psi	Pounds per square inch
psig	Pounds per square inch gage
PV	Photovoltaic
PVC	Polyvinyl-chloride
PWA	Proposed wilderness area
RAWS	Remote Automatic Weather Stations
R/C	Retention/Consolidation
R/M	Retention/Management

RMP	Resource Management Plan
ROD	Record of Decision
ROW	Right-of-way
RTDM	Ranger Terrain Dispersion Model
S	Sulfur
SCORP	[Nevada] Statewide Comprehensive Outdoor Recreation Plan
SCS	U.S. Department of Agriculture, Soil Conservation Service
SEC	U.S. Securities Exchange Commission
SEL	Sound exposure level
SHPO	[Nevada] State Historic Preservation Office
SiO_2	Silica
SMUD	Sacramento Municipal Utilities District
SO_2,SO_4	Sulfur dioxide, sulfates
SO_x	Sulfur oxides
SP	Spontaneous or Self Potential
SPPC	Sierra Pacific Power Company
SPR	Sierra Pacific Resources
SPRR	Sierra Pacific Railroad
SPTC	Southern Pacific Transportation Company
sq ft	Square foot/feet
sq mi	Square mile
SRA	State Recreation Area
SVR	Standard visual range
SWIP	Southwest Intertie Project
TDEM	Time Domain Electromagnetic
TDS	Total dissolved solids

TF	Toxic factors
THAC	Toxic or hazardous air contaminant
TLV	Threshold limit value
TSGC	Thousand Springs Generating Company
TSP	Total suspended particulates
TSPP	Thousand Springs Power Plant
TSS	Total suspended solids
$\mu eq/L$	Micro equivalents per liter
$\mu g/m^3$	Micrograms per cubic meter
μm	microns or micrometers
UP	Union Pacific Railroad
$\mu N/m^2$	Micronewtons per meter squared
$\mu S/cm$	Microsiemens per centimeter
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
V	Volt
VOC	Volatile organic compound
VRM	Visual resource management
WCC	Woodward-Clyde Consultants
WA	Wilderness area
WSA	Wilderness study area
WSCC	Western System Coordinating Council
yr	Year

12.0
SUPPLEMENTARY MAPS

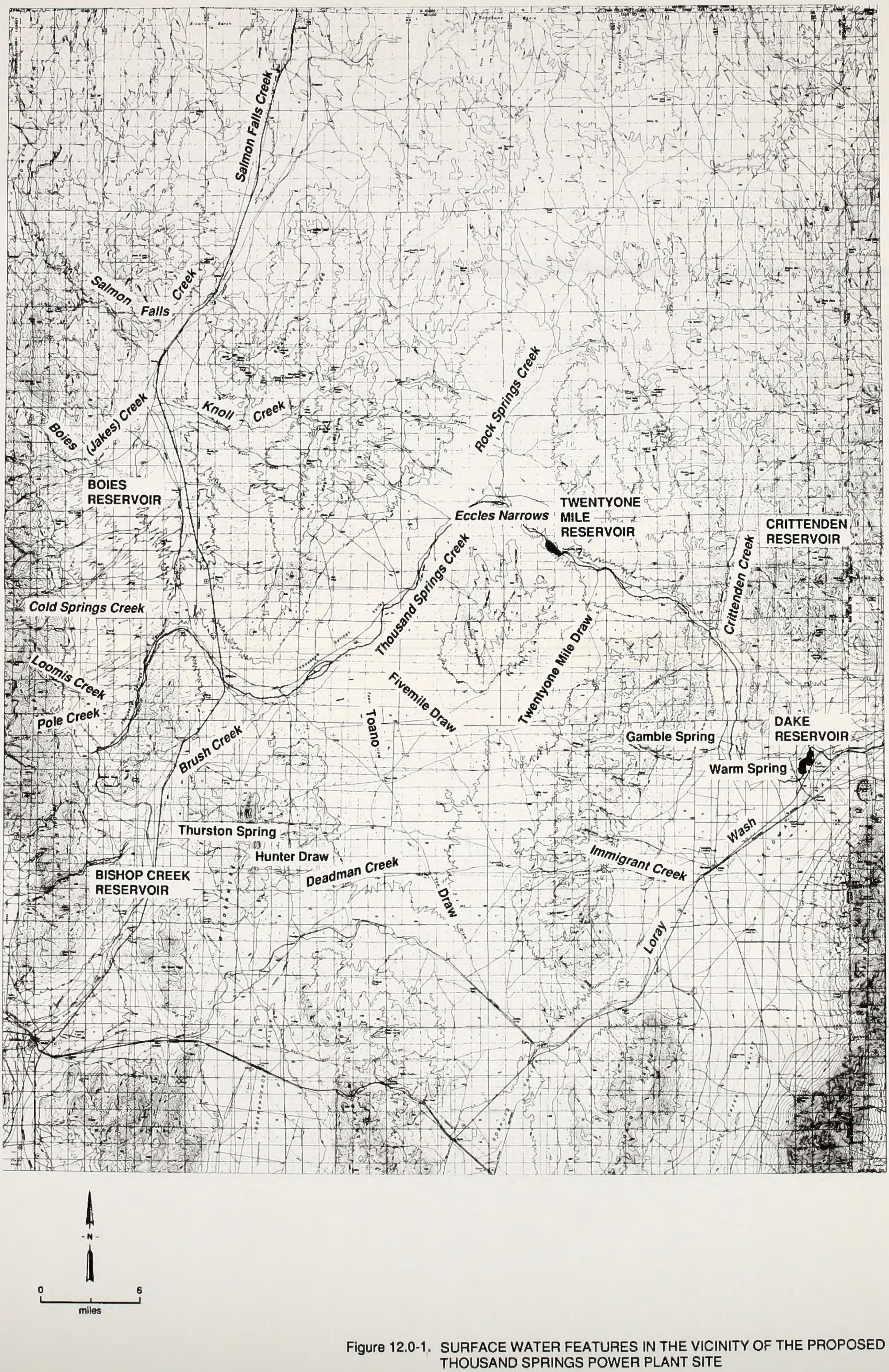

Figure 12.0-1. SURFACE WATER FEATURES IN THE VICINITY OF THE PROPOSED THOUSAND SPRINGS POWER PLANT SITE

Figure 12.0-2. SELECTED GEOGRAPHIC AND PHYSIOGRAPHIC FEATURES IN THE VICINITY OF THE PROPOSED THOUSAND SPRINGS POWER PLANT SITE

APPENDIX A-1
VISUAL RESOURCES GLOSSARY

BACKGROUND The area of a distance zone which lies beyond the foreground-middleground. Usually from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

BASIC ELEMENTS The four major elements (form, line, color and texture) which determine how the character of a landscape is perceived.

CHARACTER TYPE Large physiographic area of land which has common characteristics of landforms, rock formations, water forms, and vegetative patterns.

CHARACTER SUBTYPE A division of a major character type which is significantly different in visual characteristics from the other subtypes.

CHARACTERISTIC LANDSCAPE The established landscape within an area being viewed. The term does not necessarily mean a naturalistic character. It could refer to a farming community, an urban landscape, a primarily natural environment, or other landscape which has an identifiable character.

CONTRAST The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

CULTURAL MODIFICATION Any man-caused change in the land or water form or vegetation or the addition of a structure which creates a visual contrast in the basic elements (form, line, color, texture) of the naturalistic character of a landscape.

DISTANCE ZONE The area that can be seen as foreground-middleground, background, or seldom seen. Areas of the landscape denoted by specified distances from the observer. The term is used as a frame of reference to discuss landscape characteristics or activities of man.

FOREGROUND-MIDDLEGROUND The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape, and vegetation is apparent only in patterns or outline.

INTRUSION A feature (land or water form, vegetation, or structure) which is generally considered out of context because of excessive contrast and disharmony with the characteristic landscape.

KEY OBSERVER POSITION (KOP) One or a series of observer positions on a travel route or at a use or a potential use area used to determine seen area.

LANDSCAPE CHARACTER The arrangement of a particular landscape as formed by the variety and intensity of the landscape features and the four basic elements (form, line, color, and texture). These factors give the area a distinctive quality which distinguishes it from its immediate surroundings.

LANDSCAPE FEATURES The land and water forms, vegetation, and structures which compose the characteristic landscape.

OBSERVER POSITION The placement and relationship of a view to the landscape which is being perceived.

PHYSIOGRAPHIC PROVINCE An extensive portion of the landscape, normally encompassing many hundreds of square miles, which has common qualities of soil, rock, slope and vegetation of the same geomorphic origin.

SCENIC AREA An area whose landscape character has a high degree of variety, harmony, and contrast among the basic visual elements which result in a landscape pleasant to view.

SCENIC QUALITY CLASS The value (A, B, or C) assigned to a scenic quality rating unit by applying the scenic quality evaluation key factors which indicate the relative visual importance of the unit to the other units within the same physiographic region.

SEEN AREA That portion of the landscape which can be viewed from one or more observer positions. The extent or area that can be viewed is normally limited by landform, vegetation, or distance.

SENSITIVITY As applied to visual resource management, that degree of concern expressed by the user toward scenic quality and present or proposed visual change in a particular characteristic landscape.

USE VOLUME The total volume of visitor use each segment of a travel route or use area receives.

VIEW Something, especially a broad landscape or panorama, that is looked toward or kept in sight. The act of looking toward this object or scene.

VISUAL RESOURCE The land, water, vegetative, animal, and other features that are visible on all lands (scenic values).

VISUAL RESOURCE MANAGEMENT (VRM) The planning, design, and implementation of management objectives to provide acceptable levels of visual impacts for all BLM resource management activities.

VISUAL RESOURCE MANAGEMENT CLASS Indicates the degree of visual change that is acceptable within the characteristic landscape. It is based on the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

1. Class I. This class provides primarily for natural ecological changes; however, it does not preclude very limited management activity. Any contrast created within the characteristic environment must not attract attention. The class is applied to wilderness areas, some natural areas, wild portions of the Wild and Scenic Rivers, and some similar places where management activities must be restricted.

2. Areas of Critical Environmental Concern for Scenic Values. The ACEC for scenic values are defined as lands of high scenic value of relative scarcity. For this reason, priority identification must be made for presentation in the management framework process. Conformance with VRM Class II objectives interim management is required.

3. Class II. Changes in any of the basic elements (form, line, color, texture) caused by a management activity should not be evident in the characteristic landscape. A contrast may be seen but should not attract attention.

4. Class III. Contrasts to the basic elements (form, line, color, texture) caused by a management activity may be evident and begin to attract attention in the characteristic landscape.

However, the changes should remain subordinate to the present characteristic landscape.

5. Class IV. Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape.

6. Class V. Change is needed or change may add acceptable visual variety to an area. This class applies to areas where the naturalistic character has been so disturbed that rehabilitation is needed to being it back into character with the surrounding landscape. This class would apply to areas identified in the scenic evaluation where the quality class has been reduced because of unacceptable cultural modification (the contrast is inharmonious with the characteristic landscape). It may also be applied to areas that have the potential for enhancement, i.e., where acceptable visual variety could be added to an area/site. It should be considered an interim or short-term classification until one of the other VRM class objectives can be reached through rehabilitation or enhancement. The desired Visual Resource Management class should be identified.

VISUAL SENSITIVITY LEVEL(S) An index of the relative degree of user interest in scenic quality and concern and attitude toward present or proposed changes in the landscape features of an area in relation to other areas in the planning unit.

However, the changes should remain subordinate to the present characteristic landscape.

5. Class IV. Contrasts may attract attention and be a dominant feature of the landscape in terms of scale; however, the change should repeat the basic elements (form, line, color, texture) inherent in the characteristic landscape.

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VISUAL SENSITIVITY LEVEL(S): An index of the relative degree of user interest in scenic quality and concern for visual changes caused by proposed changes in the landscape features of an area in relation to other areas in the planning unit.

APPENDIX A-2

BLM VRM MANUAL AND WORKSHEETS

Scenic Quality - Inventory and Evaluation Chart

SCENIC QUALITY
INVENTORY AND EVALUATION CHART

key factors	rating criteria and score		
landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops; or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. 5	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or detail features which are interesting though not dominant or exceptional. 3	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. 1
vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. 5	Some variety of vegetation, but only one or two major types. 3	Little or no variety or contrast in vegetation. 1
water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. 5	Flowing, or still, but not dominant in the landscape. 3	Absent, or present, but not noticeable. 0
color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. 5	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element. 3	Subtle color variations, contrast, or interest; generally mute tones. 1
influence of adjacent scenery	Adjacent scenery greatly enhances visual quality. 5	Adjacent scenery moderately enhances overall visual quality. 3	Adjacent scenery has little or no influence on overall visual quality. 0
scarcity	One of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. 1/ 5+	Distinctive, though somewhat similar to others within the region. 3	Interesting within its setting, but fairly common within the region. 1
cultural modifications	Modifications add favorably to visual variety while promoting visual harmony. 2	Modifications add little or no visual variety to the area, and introduce no discordant elements. 0	Modifications add variety but are very discordant and promote strong disharmony. −4

1/ A rating of greater than 3 can be given but must be supported by written justification.

INSTRUCTIONS

Purpose: To rate the visual quality of the scenic resource on all BLM managed lands.

How to Identify Scenic Value: All Bureau lands have scenic value.

How to Determine Minimum Suitability: All BLM lands are rated for scenic values. Also rate adjacent or intermingling non-BLM lands within the planning unit.

When to Evaluate Scenic Quality: Rate the scenery under the most critical conditions (i.e., highest user period or season of use, sidelight, proper atmospheric conditions, etc.).

How to Delineate Rating Areas: Consider the following factors when delineating rating areas.

1. Like physiographic characteristics (i.e., land form, vegetation, etc.).

2. Similar visual patterns, texture, color, variety, etc.

3. Areas which have a similar impact from cultural modifications (i.e., roads, historical and other structures, mining operations, or other surface disturbances).

Explanation of Criteria: (See Illustration 1)

NOTE: Values for each rating criteria are maximum and minimum scores only. It is also possible to assign scores within these ranges.

SCENIC QUALITY

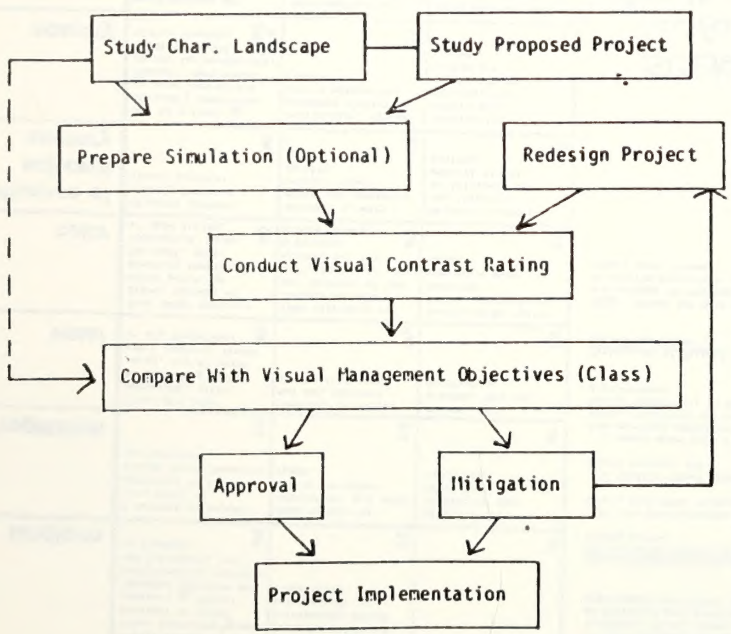
A = 19 or more
B = 12–18
C = 11 or less

VRM - Contact

NO.	NAME	landform	vegetation	water	color	influence	scarcity	cultural mod.	TOTAL	CLASS	item
320	Contact Hills	5	3	3	3	2	3	-2	17	B	
321	Granite Range	4	3	3	3	1	2	-2	14	B	
322	Rock Spring	3	2	3	2	3	1	0	14	B	
323	Bald Mtn.	3	1	0	3	1	1	2	11	C	
324	Delano Mtn.	4	3	2	4	1	1	-1	14	B	
325	Vilkins Valley	1	1	2	1	3	1	1	10	C	= Class IV
326	Snake Valley	1	1	0	1	2	1	0	6	C	
327	Snake Mtn.	3	2	2	2	1	1	-1	10	C	
328	Mahogany Basin	4	3	1	2	1	2	1	14	B	
329	Vilson Creek	3	3	3	3	3	2	2	19	A	
** 330	North Fork Salmon Falls Creek	3	2	3	3	1	1	2	15	B	
331	O'Neil Hills	3	2	1	2	1	2	1	12	B	
332	Varm Spring Hills	2	1	1	2	1	1	2	10	C	
333	Tecoma Valley	1	1	0	1	2	1	0	6	C	
334	Murdock Mtns.	3	3	0	4	1	1	2	14	B	
** 335	Boies Valley	2	3	4	4	1	2	1	17	B	
336	Five-mile Hills	2	2	0	2	1	1	2	10	C	
337	Vindermere Hills	2	2	2	3	2	1	2	14	B	
338	Twenty-One Mile Hills	2	3	1	2	1	1	2	12	B	
339	Mary's River Valley	1	1	3	1	2	1	2	11	C	

VISUAL CONTRAST RATING

The overall system of Contrast Rating, indicated in the generalized flow-chart, determines whether the proposed project meets Visual Resource Management Objectives or requires additional mitigating measures to reduce its visual contrast to acceptable levels.



VISUAL RESOURCE CONTRAST RATING

I. Purpose:

--To provide a method of determining the extent of visual impact for existing or proposed management activities or projects that will disturb the soil, change or remove vegetation, or place a structure in the landscape.

II Uses:

--As a design tool during the project planning and design process. This use can be particularly beneficial on special or non-typical projects where the evaluator has little experience in working with that type of project.

--As an environmental assessment tool to identify visual impacts of proposed management activities. These impacts are compared with the acceptable levels of change for the assigned visual management objective for the area or site to determine significance.

--To identify mitigating measures and/or stipulations that can be taken to reduce visual impacts. This is unquestionably the most vital rule of the contrast rating process. For these actions will guide the on-the-ground project construction and development; therefore helping meet the primary objective of the VRM Program in minimizing adverse visual impacts.

III. Basic Philosophy:

--The degree to which an activity adversely affects the visual quality of the landscape depends upon the amount of visual contrast that is created between the activity and the existing landscape character. The amount of contrast between a proposed activity and the existing landscape character can be measured by separating the landscape into its major features and then predicting the magnitude of change in contrast of each of the basic elements (form, line, color, and texture) to each of the features.

IV. Concepts:

A. Landscape Features - refer to the physical parts of the landscape.

1. Land and water:

--landform, topography, slopes
--rock and soil surfaces
--lakes, water courses, marshes
--ice and snow

2. Vegetation:

--trees, shrubs and low vegetation, perceived as three dimensional objects in the foreground but as two dimensional patterns over longer viewing distances.

3. Structures:

--manmade objects in the landscape, usually three dimensional (e.g., buildings, transmission towers, irrigation channels) but sometimes low-profile and two dimensional (e.g., roads).

B. Visual elements - refers to visual characteristics or basic elements in a landscape, components or individual objects.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

SCENIC QUALITY FIELD INVENTORY

NV-010

Date	Summer '80
District	Elko
Planning unit	Contact
Scenic quality rating unit	325 - Wilkins Valley

1. Evaluators *(names)*

Susan Stamps / Dove Pokorny

2. LANDSCAPE CHARACTER *(Feature)*

	a. LANDFORM/WATER	b. VEGETATION	c. STRUCTURE (General)
FORM	flat valley	rounded	cubical
LINE			
COLOR	tan	light green grey green	brown, silver
TEXTURE	smooth	smooth	smooth

3. Narrative

Wilkins is a typical valley of flat terrain with sage and desert grasses. Cultural modifications, which include ranches, fences and cattle guards, due little to add interesting visual sites to the viewshed. Thousand Springs, a perennial stream, runs throughout the unit.

4. SCORE *(Circle Appropriate Level)**

	HIGH	MEDIUM	LOW	EXPLANATION OR RATIONALE
a. Landform	5	3	1	
b. Vegetation	5	3	1	
c. Water	5	3 2	0	
d. Color	5	3	1	
e. Influence	5	3	0	
f. Scarcity	6	2	1	
g. Cultural Modification	2 1	0	-4	
TOTALS	1 +	5 +	4	10

SCENIC QUALITY CLASSIFICATION

☐ Class A – 19–33

☐ Class B – 12–18

☒ Class C – 11 or less

* See Scenic Quality Rating Criteria in BLM Manual Section 8411

Form 8400-1 (September 1978)

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date FEB 16, 1989 9:30 AM
District ELKO
Resource Area WELLS
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name THOUSAND SPRINGS POWER PLANT
2. Key Observation Point EASTBOUND INTERSTATE 80 (NE VIEW)
3. VRM Class IV VIEW DISTANCE 20 MILES
4. Location Township 34N Range 64E Section SE4 SE4 6
5. Location Sketch NORTH (BACKGROUND) I-80

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	LOW, ROUNDED, UNDULATING	UNEVEN, ROLLING, ROUNDED	(69KV LINE) NARROW, VERTICAL
LINE	HORIZONTAL	HORIZONTAL, IRREGULAR, SOFT	WEAK, STRAIGHT, SIMPLE
COLOR	DULL GREEN-GRAY (MIDDLEGROUND) MONOTONE BROWN	DULL GREEN GRAY	DARK BROWN NONREFLECTIVE
TEXTURE	FINE GRAIN	MEDIUM TO FINE DENSITY	DENSE, SUBTLE

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	NO CHANGE	PROPOSED ACTIVITY WILL NOT BE VISIBLE	
LINE			
COLOR			
TEXTURE			

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form				|				|				|
Line				|				|				|
Color				|				|				|
Texture				|				|				|

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names Robert D. Scott Date 2/16/89

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date FEB 16, 1989 10:30 AM
District ELKO
Resource Area WELLS
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name THOUSAND SPRINGS POWER PLANT
2. Key Observation Point INTERSTATE 80 EASTBOUND (NW VIEW)
3. VRM Class IV VIEW DISTANCE (25 MILES)
4. Location Township T36N Range R67E Section
5. Location Sketch NORTH I-80 (BACKGROUND)

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	LOW, UNDULATING, ANGULAR	LOW GROWING, ROUNDED, HOMOGENEOUS	(69KV LINE) NARROW VERTICAL
LINE	HORIZONTAL	HORIZONTAL	VERTICAL
COLOR	DULL WHITE, GREEN-GRAY	DULL GREEN-GRAY	DARK BROWN, NON REFLECTIVE
TEXTURE	FINE	FINE	DENSE, SUBTLE

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	NO CHANGE	PROPOSED ACTIVITY WILL NOT BE VISIBLE	
LINE			
COLOR			
TEXTURE			

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
Form				|				|				|
Line				|				|				|
Color				|				|				|
Texture				|				|				|

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names Robert D. Scott Date 2/16/89

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date FEB 16, 1989
District ELKO
Resource Area WELLS
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name THOUSAND SPRINGS POWER PLANT
2. Key Observation Point STATE ROUTE 30 (NW VIEW) VIEW DISTANCE (18 MILES)
3. VRM Class IV
4. Location Township T37N Range R67E Section SW4 NW4 20
5. Location Sketch STATE ROUTE 30 (BACKGROUND) NORTH

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	LOW UNDULATING ANGULAR	LOW GROWING, ROUNDED (LOW-GROWING)	NONE
LINE	HORIZONTAL	HORIZONTAL	NONE
COLOR	GREEN-GREY	DULL GREEN-GREY	NONE
TEXTURE	FINE	FINE	NONE

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	NO CHANGE	PROPOSED ACTIVITY WILL NOT BE VISIBLE	
LINE			
COLOR			
TEXTURE			

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	L/W Strong	L/W Moderate	L/W Weak	L/W None	Veg Strong	Veg Moderate	Veg Weak	Veg None	Str Strong	Str Moderate	Str Weak	Str None
Form												
Line												
Color												
Texture												

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)
3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names Robert D Scott
Date 2/16/89

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date FEB 16, 1989
District ELKO
Resource Area WELLS 12:40 pm
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name THOUSAND SPRINGS POWER PLANT
2. Key Observation Point US 93 SOUTHBOUND (SOUTHEAST VIEW)
3. VRM Class IV VIEW DISTANCE (16 MILES)
4. Location Township T41N Range R64E Section SW4 SE4 17
5. Location Sketch NORTH (BACKGROUND) US 93 ... POND SITE

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	HORIZONTAL, LOW, UNDULATING ROLLING BACKGROUND	FLAT UNEVEN MOTTLED	
LINE	HORIZONTAL	HORIZONTAL, (SUBTLE CONVERGING)	LOW VERTICAL ...
COLOR	GREEN-GRAY TAWNY	GREEN-GRAY AND TAN	DARK SILOUETTE
TEXTURE			

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM			POWER PLANT BLOCKY, COLUMNER, SOLID
LINE			VERTICAL
COLOR			GRAY WHITE DULL MEDIUM-DARK BROWN DULL
TEXTURE			SMOOTH

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1. DEGREE OF CONTRAST

ELEMENTS	L/W Strong	L/W Moderate	L/W Weak	L/W None	Veg Strong	Veg Moderate	Veg Weak	Veg None	Str Strong	Str Moderate	Str Weak	Str None
Form		X				X				X		
Line		X				X			X			
Color			X			X				X		
Texture			X				X				X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)
3. Additional mitigating measures recommended ☐ Yes ☐ No (Explain on reverse side)

Evaluator's Names Robert D Scott
Date 2/16/89

Visual Contrast Rating Worksheet

I-1 US 93 SOUTHBOUND, SE VIEW

SECTION D. (Continued)

Comments from item 2.

Additional Mitigating Measures (See item 3)

COLOR OF THE STACKS SHOULD BLEND WITH THE EARTHTONE ...
OF THE ADJACENT LANDSCAPE NEAR THE PROPOSED FACILITY.
COLOR SHOULD BE A SHADE DARKER THAN THE PREDOMINANT SOIL COLOR.

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

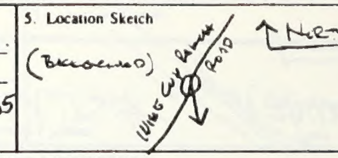
Date FEB 16, 1989 1:15 pm
District ELKO
Resource Area WELLS
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name THOUSAND SPRINGS POWER PLANT
2. Key Observation Point WINECUP RANCH ROAD (SOUTH VIEW)
3. VRM Class IV NEW DESIGNATION (UNLESS)

4. Location
Township T42N
Range R65E
Section NW4SE4 35

5. Location Sketch



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	LOW, ROUNDED	LOW, UNEVEN, MOTTLED	LOW, VERTICAL NARROW
LINE	HORIZONTAL, LOW CURVILINEAR	HORIZONTAL SOFT UNDULATING	VERTICAL
COLOR	MEDIUM BROWN	GREEN GRAY, TAWNY RED-BROWN	MEDIUM DULL ...
TEXTURE	FINE	MEDIUM FINE	FINE

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM		POWER PLANT	BULKY, COLUMNAR, ...
LINE			VERTICAL
COLOR			GRAY WHITE DULL MEDIUM-DARK BROWN DULL
TEXTURE			SMOOTH

SECTION D. CONTRAST RATING ☐ SHORT TERM ☒ LONG TERM

1\.

DEGREE OF CONTRAST	LAND/WATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
ELEMENTS Form		X				X			X			
Line		X				X			X			
Color			X			X				X		
Texture			X				X				X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: Robert D Scott
Date: 2/16/89

Visual Contrast Rating Worksheet

For AB Wingcup Rowan Road (North View)

SECTION D (Continued)

Comments from item 2.

Additional Mitigating Measures (See item 3)

Color of the facility and stack should repeat the similar color of the predominant earthtone color of the soil in view. Stack color should be a shade darker color than the predominant soil color. Form and line of the facilities should repeat or accentuate the horizontal lines of the surrounding landscape. Consideration of facility design should be given to blend in with those predominant landscape elements.

BLM MANUAL

Rel. 8-30
1/17/86

Form 8400-4
(September 1985)

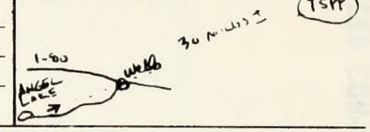
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date August 22 1989 (amended November 27, 1989)
District Elko
Resource Area Wells
Activity (program) TSPP

SECTION A. PROJECT INFORMATION

1. Project Name Thousand Springs Power Plant	4. Location	5. Location Sketch
2. Key Observation Point Angel Lake Campground Road	Township T36N	
3. VRM Class — View Distance 30 miles	Range R61E	
	Section 3	



SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	Low Flat Angular and Blocky	Low	Random Scattered Blocky
LINE	Horizontal	Flat	Straight & Sweep Curves in Middleground & Background
COLOR	Green/Brown/Gray	Dull Green-Gray	Light and Dark Gray and Blue
TEXTURE	Fine	Fine / Smooth	Fine

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LAND/WATER	2. VEGETATION	3. STRUCTURES
FORM	No Change Proposed Activity will Not Be Visible		
LINE			
COLOR			
TEXTURE			

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1.

DEGREE OF CONTRAST	Land/Water Body (1) Strong	Moderate	Weak	None	Vegetation (2) Strong	Moderate	Weak	None	Structures (3) Strong	Moderate	Weak	None
ELEMENTS: Form												
Line												
Color												
Texture												

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names	Date
Robert Scott	8/22/89; amended 11/27/89

APPENDIX B
METHODS AND ASSUMPTIONS USED TO DEVELOP POPULATION AND EMPLOYMENT PROJECTIONS

Estimates of the increase in direct and indirect employment and population are based on information provided by the project proponent on anticipated workforce and construction schedule, as well as assumptions concerning worker marital status and family size, secondary employment effects, and the distribution of inmigrating workers among the affected local communities. Population increases in the study area would occur during both the construction and the operation phases of the project.

Data sources for this analysis include the project proponent, relevant existing studies, census data, and local agencies. Anticipated workforce and construction schedule data have been provided by the project proponent. Assumptions concerning marital status, family size, distribution of inmigrants among the local communities, as well as the number of local hires and support jobs that would result from the project, were based on census data; experience with a similar power plant at Valmy, Nevada; socioeconomic case studies on power plant development conducted by Electric Power Research Institute (EPRI 1982, 1984); and discussions with agency personnel familiar with the study area. The Valmy power plant experience is particularly applicable because the power plant units that are proposed at Thousand Springs are similar to those at Valmy. The Valmy power plant, located between Winnemucca and Battle Mountain, was constructed during a period of increased mining activity. This is similar to the current situation in the Elko area. In addition, the construction crew at Valmy used a construction-worker camp. (Two alternatives are being considered for the construction workforce accommodation component of this project: a construction-worker camp alternative, and the no construction-worker camp alternative.)

The EPRI (1982) case studies examined the socioeconomic effects of power plant construction and operation in 12 communities. Research findings were based on case studies of the 12 power plants and a review of more than 600 documents. The case studies examined both anticipated effects and actual effects. Nine of the power plants studied were coal-fired power plants. Population and employment estimates for this proposed project were generated from the data contained in these sources and have been discussed with local agency personnel.

The construction and operation workforce estimates are based on the assumption that the construction of a new unit would begin every 2 years.

In reality, construction of the units would depend on market demand for electricity. The schedule, therefore, could either compress or lengthen from the planned schedule, which is based on the anticipated construction of one unit every 2 years. The peak construction workforce is the peak during that given year; therefore, while the peak workforce is 800, the average workforce throughout that year could be 500. It is not known how long the peak would last but it is anticipated to last anywhere from less than a month up to 2 to 3 months. In addition, because the workforce consists of a combination of workers finishing one unit as others begin another, the peak workforce for the year could be overstated if the peak workforces for each unit do not occur at the same time of year. Tables B-1 and B-2 present the anticipated peak construction and operation workforces in each year. The total anticipated workforce in each year is shown in Table B-3 and on Figure B-1.

This appendix discusses the indirect effects of these anticipated construction and operation jobs in four categories:

- Construction workforce with a construction-worker camp
- Construction workforce without a construction-worker camp
- Operation workforce
- Peak total workforce

CONSTRUCTION WORKFORCE WITH A CONSTRUCTION-WORKER CAMP

The construction workforce would consist of tradespeople who might have assignments of limited duration. Therefore, even if a workforce is described as being at a certain size (for example, 500 average in a given year), it is unlikely that the same 500 workers would be employed throughout the year. It is more likely that tradespeople would move in and out of the area for temporary employment. The workforce might reach a peak of 800, but average only 500 over the course of the year. Some tradespeople (e.g., laborers) might be employed for the duration of the project, while others (e.g., painters) might be employed for shorter periods of time on each of the power plant units.

The peak construction workforce would be 805 workers in 1993. Based on the experience at Valmy, it is estimated that approximately 10 percent of the workforce would be hired locally and, therefore, would already be served by the existing community services. The local workforce would not live in the construction-worker camp. At the peak, it is assumed that the camp of 220 dormitory rooms and 300 RV spaces would be full. Therefore, the inmigration of workers to local communities would consist of 205 workers (805 peak jobs minus 80 local hires minus 520 workers living in the construction-worker camp). The population in the local communities would likely be smaller than 205 because each RV space in the construction-worker camp could support more than one worker. During the peak months, this doubling up would likely occur. However, for the purpose of a worst-case analysis, it is assumed that only one worker would reside in each RV space. The inmigrating workforce would consist of those workers who do not

Table B-1. ANTICIPATED PEAK CONSTRUCTION WORKFORCE BY YEAR

Year	Unit 1	2	3	4	5	6	7	8	Total
1991	289								289
1992	653								653
1993	717	88							805
1994	70	255							325
1995		610	85						695
1996		70	255						325
1997			610	85					695
1998			70	255	100				425
1999				610	190				800
2000				70	653				723
2001					717	88			805
2002					70	255			325
2003						610	85		695
2004						70	255		325
2005							610	85	695
2006							70	255	325
2007								610	610
2008								70	70
2009								40	40

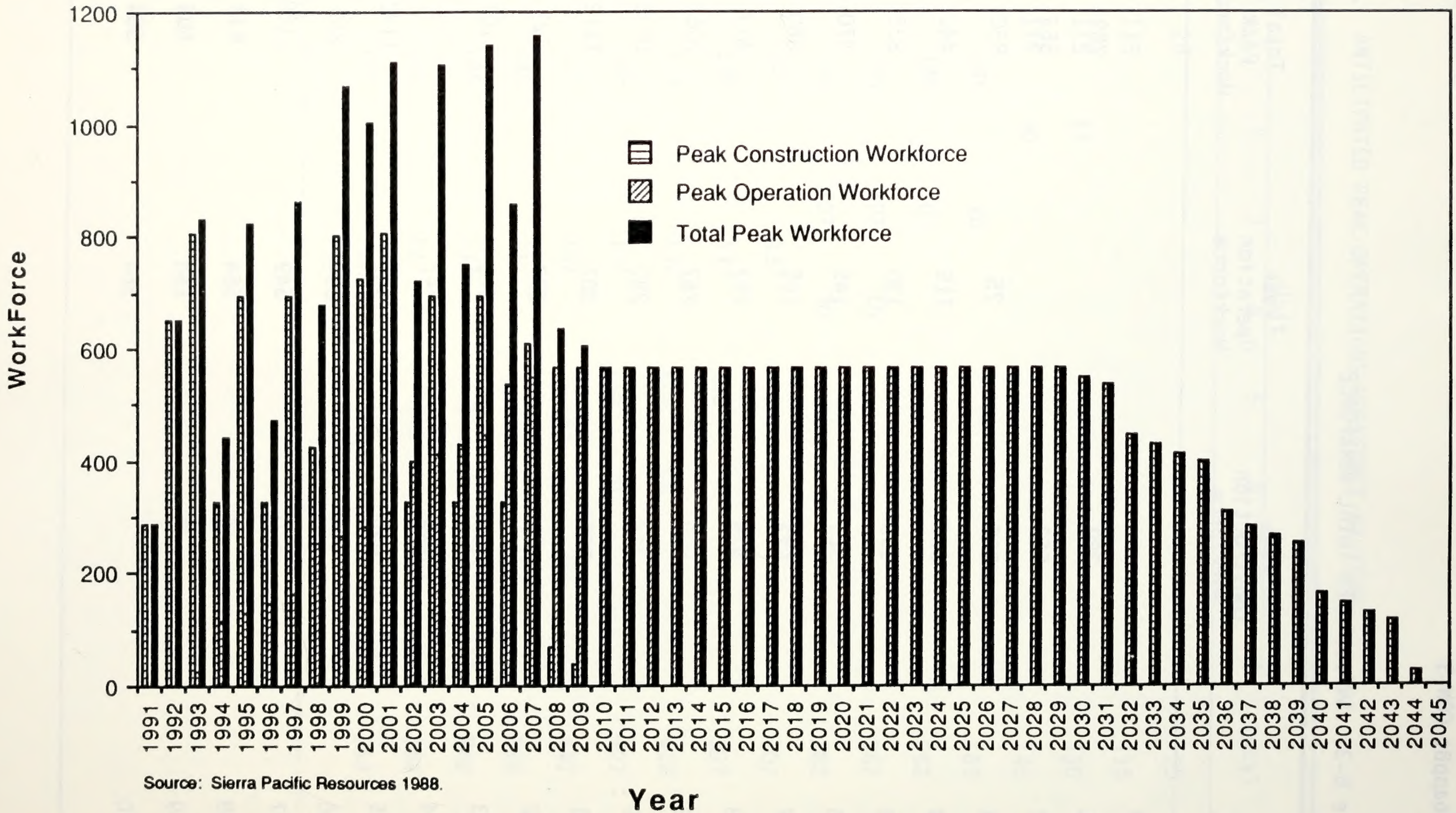
Table B-2. ANTICIPATED PEAK OPERATIONS WORKFORCE BY YEAR

Year	Unit 1	2	3	4	5	6	7	8	Total
1993	25								25
1994	115								115
1995	115	15							130
1996	115	30							145
1997	145		20						165
1998	145		107						252
1999	145		107	15					267
2000	145		107	30					282
2001	145		137		25				307
2002	145		137		115				397
2003	145		137		115	15			412
2004	145		137		115	30			427
2005	145		137		145		20		447
2006	145		137		145		107		534
2007	145		137		145		107	15	549
2008	145		137		145		107	30	564
2009	145		137		145		137		564

Table B-3. ANTICIPATED TOTAL WORKFORCE

Year	Peak Construction Workforce	Peak Operation Workforce	Total Peak Workforce
1990			
1991	289		289
1992	653		653
1993	805	25	830
1994	325	115	440
1995	695	130	825
1996	325	145	470
1997	695	165	860
1998	425	252	677
1999	800	267	1067
2000	725	282	1005
2001	805	307	1112
2002	325	397	722
2003	695	412	1107
2004	325	427	752
2005	695	447	1142
2006	325	534	859
2007	610	549	1159
2008	70	564	634
2009	40	564	604
2010		564	564

Anticipated Peak Workforce



Source: Sierra Pacific Resources 1988.

Figure B-1. ANTICIPATED PEAK WORKFORCE

live in the construction-worker camp because they prefer to live in town or because they want their families to accompany them and those workers who are on a waiting list to get into the construction-worker camp. The average workforce during that peak year is expected to be approximately 500. As the number of workers decreases from the peak and workers on the waiting lists move into the construction-worker camp, it is anticipated that the number of workers in the communities would decrease somewhat from 205; however, the workers who prefer to live in town and the workers with families would be expected to remain in the communities. In this way, the construction-worker camp would absorb the fluctuations in the size of the construction workforce, while the population in the local communities would remain relatively constant.

Dependents

In order to estimate the number of children accompanying the inmigrating workers into the communities, data from the Valmy experience were examined. Surveys of Valmy construction personnel were conducted twice a year to determine the residence location of the construction workers and number of children associated with the project who were enrolled in local schools. The results of three representative surveys showed that for each worker who lived in the towns, an average of 0.55 children were in the school systems. These surveys did not report marital status so the assumption associates school-aged children with workers, single or married. Using this assumption, it can be estimated that 113 school-aged children would arrive in towns with the peak construction workforce (205 workers times 0.55 children).

The EPRI studies suggest average family sizes of about 3.3 for construction-worker families, but caution that family sizes should be examined in each particular study area. The average family size in Elko County in 1980 was 3.24. It is assumed that all families that choose to relocate have two parents and 1.24 children. Of these children, it can be assumed that 70 percent are school-aged (5-17 years). Therefore, there would be 0.868 (1.24 times 70 percent) school-aged children per family. With 113 school-aged children per family, there are 130 families (130 families times 0.868 school-aged children per family equals 113 school-aged children). In addition, it is assumed that 130 spouses would accompany the town workers. The population increase in the communities would be approximately 448 people (Figure B-2), consisting of 205 workers, 130 spouses, and 113 children. (This peak number of 448 people in the communities could decrease slightly with an average workforce as single or unaccompanied workers on the waiting list for the construction-worker camp moved into the camp as spaces became available. However, it is assumed that the number of children in town would remain constant, because workers that have relocated families to the area would not likely move into the camp.)

Indirect Jobs

In addition to the direct jobs provided by the construction of the power plant, other indirect jobs would be created through a "ripple" effect

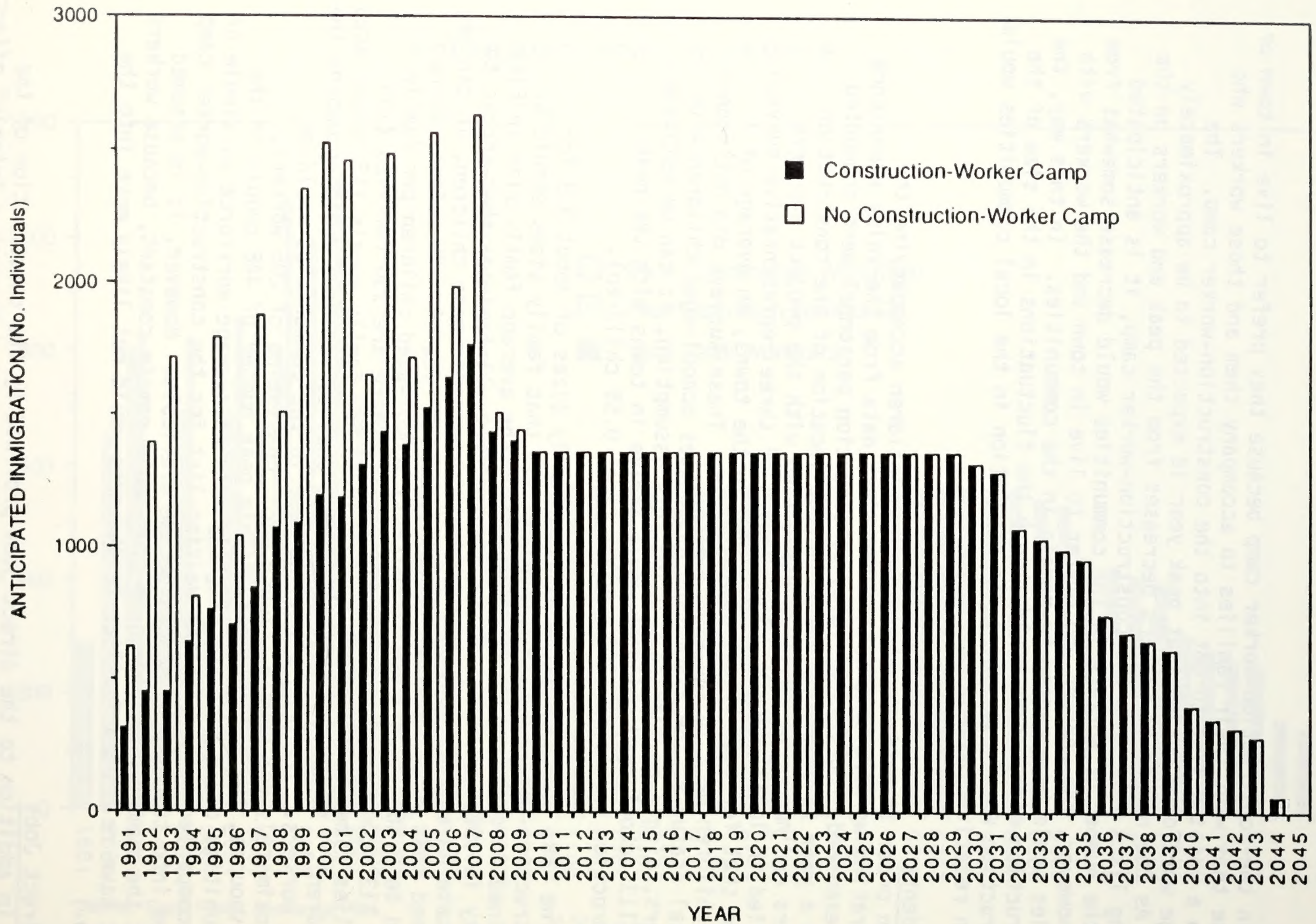


Figure B-2. ANTICIPATED INMIGRATION BY YEAR

in the local economy. The estimation of an employment multiplier can be calculated by a variety of methods, including through the use of input-output models, and these multipliers vary widely. The EPRI case studies examined the predicted increase in service jobs and compared it to the actual increase in such jobs. As a general rule, the EPRI studies found that support jobs were overestimated for two reasons. One reason was that support jobs were calculated annually for the peak workforce, but in actuality, the local community did not add service jobs for the short duration of a peak. In addition, the studies found that the percentage of local hires was higher than predicted and, therefore, fewer new local service jobs were needed to handle immigrants. The studies also found that multipliers were lower in the rural areas due to "leakage" of purchases because of the relatively poor availability of local goods and services. As purchases are made out of the local area, fewer support jobs are required locally. The EPRI studies estimated that for a rural area 0.1 to 0.2 new jobs were created for each peak construction job, or 0.2 to 0.3 new jobs were created for each immigrating annual average construction job.

The Nevada Bureau of Mines and Geology has conducted studies with an export base model to estimate employment multipliers in the mining industry in Nevada. These studies have estimated that each new export industry job results in 0.75 support jobs in the local rural area and 0.50 support jobs in the urban area. Power plants would be considered an export industry.

These employment multipliers can be used in this analysis to estimate support jobs. Thus, the project could result in as few as 120 or as many as 375 additional support jobs in the local area. Approximately 50 of these jobs would be at the construction-worker camp itself and these jobholders would also reside at the camp. The remaining new support jobs would be filled by unemployed residents of the communities, by dependents that would accompany inmigrating construction workers (spouses and high school-aged children), or by people who would inmigrate to fill the jobs. Since the support jobs would primarily employ unskilled labor at low rates, it is unlikely that many people would relocate to fill these jobs. Depending on the number of people in the last category, the population in the communities could increase slightly.

<u>Residence Distribution</u>

The inmigrating construction and operation workers could choose to live in one of several existing communities. The choice would depend on preference for residential characteristics such as the number and availability of public and private amenities and the commute distance. Housing availability is another important consideration in residential selection.

Much study of the gravity model was conducted during the late 1970s and was associated with energy development in the rural western United States. However, most use of the model has been for urban areas, where service supply is more uniform across communities. Success rates of gravity model prediction have been lower in rural areas of the United States (Murdock et al. 1978).

Perhaps the method most widely used to project residential settlement is a mechanical method known as a gravity allocation model (Murdock et al. 1978). A gravity model predicts settlement based on the relationship between positive aspects of more amenities (represented in the model by population size) and the negative aspects of longer commute distances associated with each community. All of the models assume that residential preference is the primary factor driving workforce settlement. Given the current situation in northeast Nevada, housing availability is also an important factor in settlement. Results of the models show that larger cities would attract higher percentages of the inmigrating workers. If housing availability remains low in the study region, this would likely be true, because larger cities have more ability to respond to housing demand, as long as service capacity is available. However, if reasonably priced housing were to be constructed in the closer communities of Wells and Jackpot, workers with families would likely settle in the closer communities, thereby resulting in higher percentage population increase in those communities than the models predicted.

During the course of this socioeconomic analysis, several gravity allocation models were tested. The results of these models were discussed with local officials and members of the public and suggested revisions were considered. Results of four models are provided below to present a range of predictions.

Model Assumptions. The assumptions used in these models are as follows:

- Impact communities for the site were considered within 100 miles (Murdock et al. 1978). This resulted in considering Elko, Wells, Jackpot, and Twin Falls for the proposed access road and the Brush Creek alternative and considering Elko, Wells, and West Wendover for the Moor Summit alternative.

- Assumptions of population and distance are provided in Table B-4.

Model #1. The first model considered is of the form:

$$P = \frac{\frac{Pop}{Dist^b}}{\sum \frac{Pop}{Dist^b}}$$

where P = Percent of population expected to inmigrate to community i
Pop = Population of community i
Dist = Distance from plant site to community i (in miles)
b = Distance elasticity. Commonly ranges from 0.5 to 2.0 (Murdock et al. 1978)

Table B-4. POPULATION AND DISTANCE ASSUMPTIONS

Alternative	City	Population	Distance (miles)
Proposed Access	Twin Falls	28,000	98
	Elko	16,000	90
	Wells	1,400	40
	Jackpot	1,550	55
Brush Creek	Same as proposed access		
Moor Summit	Elko	16,000	80
	Wells	1,400	29
	Wendover	4,000[a]	71

[a] Includes West Wendover, Nevada and Wendover, Utah

In the first model, b = 1 for construction workers, so that distance and population would have an equal effect. Studies have shown that operation workers are more likely to settle closer to the site (EPRI 1982), so b was chosen to equal 2 so that distance would have a stronger negative effect on the choice of residence.

Results of the model are presented in Table B-5.

Model #2. A second model was utilized which has been used by BLM in Montana. This gravity model includes an attractiveness index and different distance elasticities.

The model is as follow:

$$P = \frac{[P/\mathrm{Dist}^b]A}{\sum[\frac{\mathrm{Pop}}{\mathrm{Dist}^b}]A}$$

where A = Attractiveness index

The attractiveness index is a relative ranking of the communities for the positive aspects of local availability and incidence of public services (health care, schools, recreational facilities) and private services (stores, motels, theaters, bank, newspaper). Attractiveness indices are also reduced based on restrictions in housing availability or growth.

Using the described index, the relative ranking is:

- Twin Falls - 16
- Elko - 13.5
- Wendover - 12
- Wells - 11
- Jackpot - 9.5

In addition, BLM used distance elasticities of 1.44 for construction and 1.47 for operation (Murdock and Leistritz 1979). These elasticities were determined through a regression model of behavior of energy-related construction and operation workers in North Dakota, South Dakota, Wyoming, and Montana.

The attractiveness of higher disposable incomes and lower cost of living was also considered for inclusion in this model. The State of Idaho has a state personal income tax, which would result in a lower disposable income in Idaho than in Nevada, which does not have a state income tax. However, the State of Idaho and Twin Falls have a lower cost of living than the State of Nevada. The composite cost of living index in Twin Falls was 90.1 (on a scale of 100) and 75.8 for housing in the Fourth Quarter 1988. The urban areas of Nevada had composite indices of 102 to 105 and housing indices of 114 to 117 during the same time (American Chamber of Commerce

Table B-5. RESIDENCE DISTRIBUTION BASED ON RESULTS OF MODEL #1

Alternative	Activity	City	Calculation	Percentage
Proposed Access	Construction	Twin Falls	28,000/98	54
		Elko	16,000/90	34
		Wells	1,400/40	7
		Jackpot	1,550/55	5
	Operation	Twin Falls	$28{,}000/(98)^2$	46
		Elko	$16{,}000/(90)^2$	31
		Wells	$1{,}400/(40)^2$	15
		Jackpot	$1{,}550/(55)^2$	8
Brush Creek	Same as proposed access			
Moor Summit	Construction	Elko	16,000/79	66
		Wells	1,400/29	16
		Wendover	4,000/71	18
	Operation	Elko	$16{,}000/(79)^2$	51
		Wells	$1{,}400/(29)^2$	33
		Wendover	$4{,}000/(71)^2$	16

Researchers Association 1988). Information for northeast Nevada was not available but it is known that the recent increase in service demand in the Elko area has resulted in increased prices. The effect of the lower disposable income in Idaho would be offset by the increased purchasing power in that area and would balance the attractiveness between the two areas. In addition, studies were not found that investigated the effect of cost-of-living and disposable income on residential preference. Therefore, they were not included as variables in the gravity model.

The results from Model #2 are presented in Table B-6. The results of the construction scenario are very similar to those of Model #1. However, the construction and operation results are essentially identical, contrary to findings in EPRI case studies.

Model #3. For a third approach, the attractiveness indices were used with the distance elasticities from Model #1.

The results are presented in Table B-7.

Model #4. Based on communication with local agency officials and residents, another model was developed to consider the condition of the roads between the project site and potentially affected communities. Two aspects were considered: travel time and safety. To estimate travel time, average speeds were assumed as:

- Access roads - 35 mph
- Interstate 80 - 70 mph
- Highway 93 - 60 mph

Resulting travel times are shown in Table B-8.

Safety along commute routes was also considered. One trouble spot along Highway 93 is on HD Summit, which has been closed periodically in the winter. HD Summit is located between Wilkins and Wells and would, therefore, affect travel to and from Wells and Elko, and the project site. Other unsafe areas have been identified at Moor Summit, which has high accident frequency because of a deceptively high grade (High Desert Advocate 1989b), and on Highway 93 north of Wilkins (Dunn 1989).

After consideration of safety characteristics, it was decided to not include a safety component in the residence preference model. All communities would be affected by some safety concern. Therefore, the model which utilizes transportation is identical to Model #3, except that Dist = travel time instead of distance.

The results of Model #4 are provided in Table B-9.

Summary of Model Results. A summary of the model results is provided in Table B-10. Results of all the models were fairly similar. For the purpose of quantitative analysis, the results of Model #3 are used to

Table B-6. RESIDENCE DISTRIBUTION BASED ON RESULTS OF MODEL #2

Alternative	Activity	City	Calculation	Percentage
Proposed Access	Construction	Twin Falls	$[28{,}000/(98)^{1.44}]16$	57
		Elko	$[16{,}000/(90)^{1.44}]13.5$	31
		Wells	$[1{,}400/(40)^{1.44}]11$	7
		Jackpot	$[1{,}550/(55)^{1.44}]9.5$	5
	Operation	Twin Falls	$[28{,}000/(98)^{1.47}]16$	57
		Elko	$[16{,}000/(90)^{1.47}]13.5$	31
		Wells	$[1{,}400/(40)^{1.47}]11$	7
		Jackpot	$[1{,}550/(55)^{1.47}]9.5$	5
Brush Creek	Same as proposed access			
Moor Summit	Construction	Elko	$[16{,}000/(79)^{1.44}]13.5$	64
		Wells	$[1{,}400/(29)^{1.44}]11$	19
		Wendover	$[4{,}000/(71)^{1.44}]12$	17
	Operation	Elko	$[16{,}000/(79)^{1.47}]13.5$	64
		Wells	$[1{,}400/(29)^{1.47}]11$	19
		Wendover	$[4{,}000/(71)^{1.47}]12$	17

Table B-7. RESIDENCE DISTRIBUTION BASED ON RESULTS OF MODEL #3

Alternative	Activity	City	Calculation	Percentage
Proposed Access	Construction	Twin Falls	[28,000/(98)]16	60
		Elko	[16,000/(90)]13.5	31
		Wells	[1,400/(40)]11	5
		Jackpot	[1,550/(55)]9.5	4
	Operation	Twin Falls	$[28{,}000/(98)^2]16$	53
		Elko	$[16{,}000/(90)^2]13.5$	30
		Wells	$[1{,}400/(40)^2]11$	11
		Jackpot	$[1{,}550/(55)^2]9.5$	6
Brush Creek	Same as proposed access			
Moor Summit	Construction	Elko	[16,000/(79)]13.5	69
		Wells	[1,400/(29)]11	14
		Wendover	[4,000/(71)]12	17
	Operation	Elko	$[16{,}000/(79)^2]13.5$	56
		Wells	$[1{,}400/(29)^2]11$	29
		Wendover	$[4{,}000/(71)^2]12$	15

Table B-8. TRAVEL TIMES FOR MODEL #4

Alternative	City	Calculation	Travel Time
Proposed Access	Twin Falls	14(60/35)+84(60/60)	108
	Elko	14(60/35)+26(60/60)+50(60/70)	93
	Wells	14(60/35)+26(60/60)	50
	Jackpot	14(60/35)+41(60/60)	65
Brush Creek	Same as proposed access		
Moor Summit	Elko	23(60/35)+56(60/70)	87
	Wells	23(60/35)+6(60/70)	45
	Wendover	23(60/35)+47(60/70)	80

Table B-9. RESIDENCE DISTRIBUTION BASED ON RESULTS OF MODEL #4

Alternative	Activity	City	Calculation	Percentage
Proposed Access	Construction	Twin Falls	[28,000/108]16	59
		Elko	[16,000/93]13.5	33
		Wells	[1,400/50]11	5
		Jackpot	[1,550/65]9.5	3
	Operation	Twin Falls	$[28{,}000/(108)^2]16$	53
		Elko	$[16{,}000/(93)^2]13.5$	34
		Wells	$[1{,}400/(50)^2]11$	8
		Jackpot	$[1{,}550/(65)^2]9.5$	5
Brush Creek	Same as proposed access			
Moor Summit	Construction	Elko	[16,000/87]13.5	72
		Wells	[1,400/45]11	10
		Wendover	[4,000/80]12	18
	Operation	Elko	$[16{,}000/(87)^2]13.5$	65
		Wells	$[1{,}400/(45)^2]11$	18
		Wendover	$[4{,}000/(80)^2]12$	17

Table B-10. SUMMARY OF MODEL RESULTS

Alternative	City	Activity	Model 1 (Percent)	Model 2 (Percent)	Model 3 (Percent)	Model 4 (Percent)
Proposed Access	Twin Falls	Construction	54	57	60	59
	"	Operation	46	57	53	53
	Elko	Construction	34	31	31	33
	"	Operation	31	31	30	34
	Wells	Construction	7	7	5	5
	"	Operation	15	7	11	8
	Jackpot	Construction	5	5	4	3
	"	Operation	8	5	6	5
Brush Creek	Same as proposed access					
Moor Summit	Elko	Construction	66	64	69	72
	"	Operation	51	64	56	65
	Wells	Construction	16	19	14	10
	"	Operation	33	19	29	18
	Wendover	Construction	18	17	17	18
	"	Operation	16	17	15	17

describe the magnitude of effects in each community. Model #3 was chosen because it contains the attractiveness index, it has different results for construction and operation workers, and it uses distance instead of travel time as a variable (travel time has not been used in the studies reviewed).

Applying the percentages to the inmigrating peak construction workers and their families results in the distribution provided in Table B-11. The number of people living in each community would decrease as the construction workforce drops from the peak because workers on a waiting list could move into the construction-worker camp. However, the number of children would remain more or less constant because families that relocate would remain in the communities.

Summary

For the construction workforce with a construction-worker camp, approximately 80 local workers would be hired at peak construction and up to 520 additional workers would live in a construction-worker camp. At peak construction, population in the communities could increase by 448, decreasing as employment is reduced from the peak (Table B-11). The estimated peak distribution of workers and their dependents would be 269 in Twin Falls, 139 in Elko, 22 in Wells, and 18 in Jackpot for the proposed access and Brush Creek alternative. Distribution would be 309 in Elko, 63 in Wells, and 76 in Wendover for the Moor Summit alternative. The proposed action would result in a peak of 805 direct construction jobs and approximately 500 annual average construction jobs. Indirect employment could consist of as few as 120 (800 times 0.15 or 500 times 0.25) or as many as 375 (500 times 0.75) jobs, including 50 in the construction-worker camp. The local population could increase slightly if some of these jobs were filled by inmigrants, rather than by existing residents or the dependents of inmigrating power plant workers.

CONSTRUCTION WORKFORCE WITHOUT A CONSTRUCTION-WORKER CAMP

Power plant construction phase employment would consist of a peak workforce of 805 and an annual average of 500. The ranges given in this discussion are based on the differences between the average and peak workforces. Based on the Valmy experience, it is assumed that 10 percent of the construction workforce would be hired locally. Therefore, the number of inmigrating workers would range between 450 and 725.

Dependents

The EPRI case studies reported that an average of 25 percent of inmigrating construction workers were single, 25 percent were married without children, and 50 percent were married with families. For the 50 percent married with children, it is assumed that the family size is similar to the family size in Elko County, which was 3.24 in 1980. Is is assumed that approximately 70 percent of the children are school-aged children (5-17 years old). Based on these assumptions, the number of single inmigrants would range from 112 to 181. Those married without children would range from 112 to 181, while those married with families

Table B-11. POPULATION AND JOB INCREASES IN LOCAL COMMUNITIES ASSOCIATED WITH CONSTRUCTION WORKFORCE, PROPOSED ACTION

	Proposed Action[a,b]	Moor Summit Access
Population Increase		
Twin Falls	269	0
Elko	139	309
Wells	22	63
Jackpot	18	0
Wendover	0	76
Total	448	448
Increase in School-aged Children		
Twin Falls	68	0
Elko	35	78
Wells	6	16
Jackpot	4	0
Wendover	0	19
Total	113	113
Increase in Jobs[c]		
Direct	500-800	500-800

NOTE: A sensitivity analysis for these predictions is provided in Section 5.11.3.

[a]Estimates are for peak construction workforce of 800. Population increases would decrease slightly for average construction workforce.

[b]Results for Brush Creek alternative are the same as for the proposed action.

[c]Range is for average construction workforce of 500 and peak construction workforce of 800.

would range from 226 to 362. The total construction-related population increase, including both single workers and married workers with families, would range from 1068 to 1716 (Figure B-2), which would include 196 to 314 school-aged children.

Indirect Jobs

The range of support jobs, 120 to 375, would be similar to those under the construction-worker camp alternative. Depending on the available service capacity for temporary housing and feeding of construction workers, the 50 workers that would be required to serve the construction workers in the camp might not be needed to serve those same workers in the communities.

Residence Distribution

The residence distribution percentages with this alternative would be the same as for the construction-worker camp alternative. This would result in the increase shown in Table B-12.

Summary

For the construction workforce without a construction-worker camp, approximately 80 workers would be hired locally at peak construction. At peak construction, population in the communities could increase by 1716, decreasing to 1068 as employment drops back to the average annual workforce (Table B-12). Distribution of the residents would be 641 to 1030 in Twin Falls, 331 to 532 in Elko, 53 to 86 in Wells, and 43 to 68 in Jackpot for the proposed access and Brush Creek alternative. Distribution would be 737 to 1184 in Elko, 149 to 240 in Wells, and 182 to 292 in Wendover for the Moor Summit alternative. The project would result in 805 direct peak construction jobs and approximately 500 annual average jobs. The indirect jobs could be an addition of as few as 120 or as many as 375 new jobs, located in the local communities. These support jobs could be filled by existing unemployed residents, dependents (spouses and high school-aged children) who would accompany inmigrating construction workers, or workers who inmigrate to fill the jobs. Depending on the number of workers in the last category, populations in the local communities could increase.

OPERATION WORKFORCE

The operation workforce would increase slowly and steadily to operate the power plant units as the units were completed. The first operation workers are expected in 1993 for the first unit, which is planned for completion in 1994. The projected operation staff is approximately 140 workers for each successive pair of units and 564 workers for all eight units. Based on experience at the Valmy power plant, it is assumed that 10 percent of the operating workforce would be hired from the local area. As the local high school graduates became knowledgeable of the jobs and pay scales available, the 10 percent local hire assumption could increase to higher levels. However, the 10 percent estimate will be carried forward for analysis, which means an inmigration of 508 operating workers at full buildout of the power plant.

Table B-12. POPULATION AND JOB INCREASES IN LOCAL COMMUNITIES ASSOCIATED WITH CONSTRUCTION WORKFORCE, NO CONSTRUCTION-WORKER CAMP ALTERNATIVE

	Proposed Access[a]		Moor Summit	
	Average	Peak	Average	Peak
Population Increase				
Twin Falls	641	1030	0	0
Elko	331	532	737	1184
Wells	53	86	149	240
Jackpot	43	68	0	0
Wendover	0	0	182	292
Total	1068	1716	1068	1716
Increase in School-aged Children				
Twin Falls	117	188	0	0
Elko	61	97	135	217
Wells	10	16	28	44
Jackpot	8	13	0	0
Wendover	0	0	33	53
Total	196	314	196	314
Increase in Jobs				
Direct	500	800	500	800

NOTE: A sensitivity analysis for these predictions is provided in Section 5.11.3.

[a]Results for Brush Creek alternative are the same as for the proposed action.

Dependents

The EPRI case studies found that 70 to 80 percent of the operation workers were married with families, which is a higher percentage than for construction workers. Assuming that 75 percent of operation workers are married with families, that the average family size is 3.24, and that 70 percent of the children are school-aged children, the number of people inmigrating to the local communities would be 127 single workers and 381 family workers for a total population of 1361 in 2010 (Figure B-2), which would include 330 school-aged children.

Indirect Jobs

The EPRI case studies found that the employment multiplier applied to operation jobs was higher than that associated with the construction jobs because of the permanence of the operation jobs. EPRI reports an economic multiplier of 0.3-0.5 additional service jobs for each direct operation job.

Summary

For the operation workforce at full buildout of the eight power plant units, approximately 56 workers would be hired locally. Population in the communities would increase by 1362, with 722 in Twin Falls, 408 in Elko, 150 in Wells, and 82 in Jackpot for the proposed access and Brush Creek alternative. The distribution would be 763 in Elko, 395 in Wells, and 204 in Wendover for the Moor Summit alternative (Table B-13). The increase in children associated with this permanent workforce would be 330. The operation of the power plant would result in 564 direct jobs and as few as 225 (560 times 0.4) or as many a 420 (560 times 0.75) support jobs. These jobs could be filled by local, unemployed residents; dependents (spouses and high school-aged children) that would accompany the operation workers; or inmigrating workers. Population in the communities could increase if workers inmigrate for support jobs.

PEAK TOTAL WORKFORCE

The construction and operation workforces would overlap once the first unit of the power plant was completed, as shown in Table B-3. Therefore, the peak number of workers associated with the project would actually be a combination of construction and operation workers. As can be seen in Table B-3, the actual planned peak of 1150 would occur in 2007, after seven units have been completed and while the eighth unit is being constructed. Because this event would occur 20 years in the future and is difficult to predict with certainty, this analysis focuses on the peak of approximately 1100 workers around the turn of the century. The estimated population and employment increases are presented in Table B-14 based on 800 construction workers and 300 operation workers and using the same assumptions previously used for each type of worker. Given all the assumptions for workforce and schedule, population in the areas could increase by approximately 1200 if a construction-worker camp were provided and by a range of 1872 to 2520 (Figure B-2) if one were not provided. The peak in population growth would

Table B-13. POPULATION AND JOB INCREASES IN LOCAL COMMUNITIES ASSOCIATED WITH OPERATION OF ALL EIGHT UNITS

	Proposed Action[a]	Moor Summit
Population Increase		
Twin Falls	722	0
Elko	408	763
Wells	150	395
Jackpot	82	0
Wendover	0	204
Total	1362	1362
Increase in School-aged Children		
Twin Falls	175	0
Elko	99	185
Wells	36	96
Jackpot	20	0
Wendover	0	49
Total	330	330
Increase in Jobs		
Direct	564	564

NOTE: A sensitivity analysis for these predictions is provided in Section 5.11.3.

[a]Results for Brush Creek alternative are the same as for the proposed action.

Table B-14. POPULATION AND JOB INCREASES IN LOCAL COMMUNITIES ASSOCIATED WITH PEAK CONSTRUCTION WORKFORCE OF 800 AND OPERATION WORKFORCE OF 300

	Construction-Worker Camp Alternative[a]		No Construction-Worker Camp Alternative[b]	
	Proposed	Moor Summit	Proposed	Moor Summit
Population Increase				
Twin Falls	652	0	1024-1413	0
Elko	356	713	548-749	1142-1589
Wells	101	272	132-165	358-449
Jackpot	61	0	86-111	0
Wendover	0	185	0	290-400
Total	1170	1170	1790-2438	1790-2438
Increase in School-aged Children				
Twin Falls	160	0	209-280	0
Elko	88	175	113-149	232-314
Wells	25	66	29-35	79-95
Jackpot	14	0	19-24	0
Wendover	0	46	0	59-79
Total	287	287	370-488	370-488
Increase in Jobs				
Direct	800-1100	800-1100	800-1100	800-1100

[a]Estimates are for peak construction workforce of 800. Population increases in communities decrease slightly for average construction workforce.

[b]Range is for average construction workforce of 500 and peak construction workforce of 800.

occur around the turn of the century and decrease approximately 10 years later to the increase associated with the operation workforce alone, once all construction was completed.

APPENDIX C

TRAFFIC VOLUMES

The following tables show future traffic volumes on I-80 and U.S. Highway 93 for the project and alternatives (i.e., alternative access roads and no construction-worker camp).

Table 1. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION PERIOD (1993) WITH PROPOSED CONSTRUCTION-WORKER CAMP - WILKINS ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 1993 (two-way)	Estimated Existing Peak Hour Traffic (a) (one-way)	Estimated Peak Construction Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	6240	343	50	393	0.10	A
Btwn Halleck and Deeth	283	6150	338	50	388	0.10	A
West of Wells	284	6190	340	50	390	0.10	A
East of Wells	71125	5090	280	0	280	0.07	A
State Route 93							
N. of Contact/S. of Jackpot	72115	1820	100	101	201	0.20	A
South of Contact	161	1790	98	101	199	0.20	A
North of Wilkins	160	1710	94	101	195	0.20	A
South of Wilkins	159	1560	86	58	144	0.14	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 2. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000) WITH PROPOSED CONSTRUCTION-WORKER CAMP - WILKINS ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic (year 2000) (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	112	525	0.13	A
Btwn Halleck and Deeth	283	7410	408	112	520	0.13	A
West of Wells	284	7450	410	112	522	0.13	A
East of Wells	71125	6130	337	0	337	0.08	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	223	339	0.34	B
South of Contact	161	2080	114	223	337	0.34	B
North of Wilkins	160	1990	109	223	332	0.33	B
South of Wilkins	159	1810	100	143	243	0.24	B

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 3. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK OPERATION WORKFORCE PERIOD (2010) WILKINS ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 2010 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	9340	514	117	631	0.16	A
Btwn Halleck and Deeth	283	9210	507	117	624	0.16	A
West of Wells	284	9270	510	117	627	0.16	A
East of Wells	71125	7620	419	0	419	0.10	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2530	139	230	369	0.37	B
South of Contact	161	2500	138	230	368	0.37	B
North of Wilkins	160	2380	131	230	361	0.36	B
South of Wilkins	159	2170	119	160	279	0.28	B

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 4. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION PERIOD (1993) - NO CONSTRUCTION-WORKER CAMP ALTERNATIVE WILKINS ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 1993 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	6240	343	108 - 171	451 - 514	0.11 - 0.13	A
Btwn Halleck and Deeth	283	6150	338	108 - 171	446 - 509	0.11 - 0.13	A
West of Wells	284	6190	340	108 - 171	448 - 511	0.11 - 0.13	A
East of Wells	71125	5090	280	0 - 0	280 - 280	0.07 - 0.07	A
State Route 93							
N. of Contact/S. of Jackpot	72115	1820	100	222 354	322 454	0.32 - 0.45	B
South of Contact	161	1790	98	222 - 354	320 - 452	0.32 - 0.45	B
North of Wilkins	160	1710	94	222 - 354	316 - 448	0.32 - 0.45	B
South of Wilkins	159	1560	86	125 - 199	211 - 285	0.21 - 0.28	B

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 5. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000) NO CONSTRUCTION-WORKER CAMP ALTERNATIVE - WILKINS ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 2000 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	170 - 234	583 - 647	0.15 - 0.16	A
Btwn Halleck and Deeth	283	7410	408	170 - 234	578 - 642	0.14 - 0.16	A
West of Wells	284	7450	410	170 - 234	580 - 644	0.14 - 0.16	A
East of Wells	71125	6130	337	0 - 0	337 - 337	0.08 - 0.08	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	344 - 477	460 - 593	0.46 - 0.59	C
South of Contact	161	2080	114	344 - 477	458 - 591	0.46 - 0.59	C
North of Wilkins	160	1990	109	344 - 477	453 - 586	0.45 - 0.59	B-C
South of Wilkins	159	1880	103	210 - 285	313 - 388	0.31 - 0.39	B

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 6. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION PERIOD (1993) WITH PROPOSED CONSTRUCTION-WORKER CAMP - MOOR SUMMIT ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 1993 (two-way)	Estimated Existing Peak Hour Traffic (a) (one-way)	Estimated Peak Construction Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	6240	343	108	451	0.11	A
Btwn Halleck and Deeth	283	6150	338	108	446	0.11	A
West of Wells	284	6190	340	108	448	0.11	A
East of Wells	71125	5090	280	130	410	0.10	A
West of Pequop Summit	165	5020	276	27	303	0.08	A
West of Oasis	144	5040	277	27	304	0.08	A
State Route 93							
N. of Contact/S. of Jackpot	72115	1820	100	0	100	0.10	A
South of Contact	161	1790	98	0	98	0.10	A
North of Wilkins	160	1710	94	0	94	0.09	A
South of Wilkins	159	1560	86	0	86	0.09	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 7. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000) WITH PROPOSED CONSTRUCTION-WORKER CAMP - MOOR SUMMIT ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic (year 2000) (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	224	637	0.16	A
Btwn Halleck and Deeth	283	7410	408	224	632	0.16	A
West of Wells	284	7450	410	224	634	0.16	A
East of Wells	71125	6130	337	307	644	0.16	A
West of Pequop Summit	165	6040	332	58	390	0.10	A
West of Oasis	144	6070	334	58	392	0.10	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	0	116	0.12	A
South of Contact	161	2080	114	0	114	0.11	A
North of Wilkins	160	1990	109	0	109	0.11	A
South of Wilkins	159	1810	100	0	100	0.10	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 8. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK OPERATION WORKFORCE PERIOD (2010) MOOR SUMMIT ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 2010 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	9340	514	218	732	0.18	A
Btwn Halleck and Deeth	283	9210	507	218	725	0.18	A
West of Wells	284	9270	510	218	728	0.18	A
East of Wells	71125	7620	419	331	750	0.19	A
West of Pequop Summit	165	7510	413	58	471	0.12	A
West of Oasis	144	7550	415	58	473	0.12	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2530	139	0	139	0.14	A
South of Contact	161	2500	138	0	138	0.14	A
North of Wilkins	160	2380	131	0	131	0.13	A
South of Wilkins	159	2170	119	0	119	0.12	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 9. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION PERIOD (1993) - NO CONSTRUCTION-WORKER CAMP ALTERNATIVE, MOOR SUMMIT ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 1993 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	6240	343	238 - 382	581 - 725	0.15 - 0.18	A
Btwn Halleck and Deeth	283	6150	338	238 - 382	576 - 720	0.14 - 0.18	A
West of Wells	284	6190	340	238 - 382	578 - 722	0.14 - 0.18	A
East of Wells	71125	5090	280	286 - 460	566 - 740	0.14 - 0.18	A
West of Pequop Summit	165	5020	276	59 - 94	335 - 370	0.08 - 0.09	A
West of Oasis	144	5040	277	59 - 94	336 - 371	0.08 - 0.09	A
State Route 93							
N. of Contact/S. of Jackpot	72115	1820	100	0 - 0	100 - 100	0.10 - 0.10	A
South of Contact	161	1790	98	0 - 0	98 - 98	0.10 - 0.10	A
North of Wilkins	160	1710	94	0 - 0	94 - 94	0.09 - 0.09	A
South of Wilkins	159	1560	86	0 - 0	86 - 86	0.09 - 0.09	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table 10. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000) NO CONSTRUCTION-WORKER CAMP ALTERNATIVE - MOOR SUMMIT ACCESS ROUTE

Route/Location	NDOT Spot Count Station	Average Daily Traffic 2000 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	355 - 498	768 - 911	0.19 - 0.23	A
Btwn Halleck and Deeth	283	7410	408	355 - 498	763 - 906	0.19 - 0.23	A
West of Wells	284	7450	410	355 - 498	765 - 908	0.19 - 0.23	A
East of Wells	71125	6130	337	463 - 636	800 - 973	0.20 - 0.24	A
West of Pequop Summit	165	6040	332	91 - 125	423 - 457	0.11 - 0.11	A
West of Oasis	144	6070	334	91 - 125	425 - 459	0.11 - 0.11	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	0 - 0	116 - 116	0.12 - 0.12	A
South of Contact	161	2080	114	0 - 0	114 - 114	0.11 - 0.11	A
North of Wilkins	160	1990	109	0 - 0	109 - 109	0.11 - 0.11	A
South of Wilkins	159	1880	103	0 - 0	103 - 103	0.10 - 0.10	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table A. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000) WITH PROPOSED CONSTRUCTION-WORKER CAMP - WILKINS ACCESS ROUTE -- WITH MITIGATION APPLIED

Route/Location	NDOT Spot Count Station	Average Daily Traffic (year 2000) (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	81	494	0.12	A
Btwn Halleck and Deeth	283	7410	408	81	488	0.12	A
West of Wells	284	7450	410	81	491	0.12	A
East of Wells	71125	6130	337	0	337	0.08	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	161	277	0.28	B
South of Contact	161	2080	114	161	275	0.28	B
North of Wilkins	160	1990	109	161	271	0.27	B
South of Wilkins	159	1810	100	103	203	0.20	A

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.

Table B. ESTIMATED PROJECT-RELATED TRAFFIC, PEAK CONSTRUCTION AND OPERATION PERIOD (2000)
NO CONSTRUCTION-WORKER CAMP ALTERNATIVE - WILKINS ACCESS ROUTE -- WITH MITIGATION

Route/Location	NDOT Spot Count Station	Average Daily Traffic 2000 (two-way)	Estimated Peak Hour Traffic (a) (one-way)	Estimated Peak Construction and Operation Traffic (Peak Hour)	Roadway Peak Hour Traffic (one-way flow with project)	Appx. Vol./Cap. Ratio	Appx. Level-of-Service
Interstate 80							
East of Elko, west of Halleck	99	7510	413	123 - 169	536 - 582	0.13 - 0.15	A
Btwn Halleck and Deeth	283	7410	408	123 - 169	530 - 577	0.13 - 0.14	A
West of Wells	284	7450	410	123 - 169	533 - 579	0.13 - 0.14	A
East of Wells	71125	6130	337	0 - 0	337 - 337	0.08 - 0.08	A
State Route 93							
N. of Contact/S. of Jackpot	72115	2110	116	248 344	364 - 461	0.36 - 0.46	B-C
South of Contact	161	2080	114	248 344	363 - 459	0.36 - 0.46	B-C
North of Wilkins	160	1990	109	248 344	358 - 454	0.36 - 0.45	B-C
South of Wilkins	159	1880	103	152 - 206	255 - 309	0.26 - 0.31	B

(a) Based on 10 percent of average daily count and assumes maximum one-way flow would be 55 percent of two-way traffic.